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Executive Summary

Based on the assessment of the Humanitarian Demining RTD situation from early 1990 until today, summarized in D4.1 "Humanitarian Demining R&D Project Funding in Europe", this document analyzes the bottlenecks in the transfer of technology from technology development to the use in the field, and draws some lessons learned.

Four European countries (Belgium, Germany, The Netherlands and the United Kingdom) were selected, together with Japan. The situation at European level was also analysed, with emphasis on activities sponsored by the European Commission.

The developments in Humanitarian Demining (HD) during the last 10 years, as provided in D4.1, underline the fact that in a number of cases demining related developments have been terminated or at least put on hold. This is usually due to a combination of factors (bottlenecks) which can be broadly classified as either (i) Confidence, (ii) Cost, or (iii) Communication related. This document examines these bottlenecks following the country level and European analysis provided in D4.1.

Moreover, given that Humanitarian Demining RTD has been progressively incorporated within the broader "Improving Risk Management" strategic objectives of EC DG INFSO, the team did also examine in detail the development of regulatory policy surrounding Environmental Risk Management, and cross-referenced this to the development of Research and Innovation policy during FP6 and FP7 and the launch of targeted initiatives such as INSPIRE, GMES and GEOSS.

The study team have taken a number of approaches in carrying out this analysis. The team started from the existing body of literature and contacts accumulated from its extensive participation to European and national R&D programmes in the past decade, complemented where necessary with targeted literature surveys (documents, databases, and internet search). A number of direct contacts and where appropriate interviews were used for the selected countries, both to compile the analysis of the most important national activities, and to complement our analysis.

The study shows that the funding provided by the European Commission under the Framework Programme for Research and Development has led directly to the creation of an extensive portfolio of Humanitarian Demining R&D projects. The latter provided a range of research and supporting measures addressing the critical issues identified as a result of the regulatory policies developed in the field of Humanitarian Demining over the last ten years.

However, the range of *instruments* available to the EC to finance the necessary research and development were limited until the FP7 programme, which mainly led to projects under the umbrella of IST. As a first consequence, the IST programme unfortunately proved to be largely unsuitable for the small-scale development needed in a field where there is only a very limited market. From the review of the IST RTD projects it indeed appears that, at the current funding/project size, the typical timeframe of 2-3 years is very short for RTD projects, which include a fundamental research phase, a requirements phase, a specification phase, development and integration, demonstrator building, laboratory testing and initial field tests by end users, to be effective. As a second consequence, most of the research has been demonstrator-oriented and did lack (i) fundamental research under the EC Research Directorate, and (ii) the use of Co-operative research (formerly CRAFT) supporting innovative SMEs, the main industrial organizations which have been involved in HD R&D. As a third consequence, appropriate funding structures to assure adequate prototyping/ T&E/production were badly lacking.

Moreover, compared to Environmental Risk Management, the timeframe for RTD in Humanitarian Demining has not been sufficiently synchronised with the timeframe of the EC regulations. The separation of the Mine Action and RTD funding streams did also negatively affect the take-up of new technologies.

As a conclusion, creating coherence between: (1) the EU policy based on political decisions, (2) R&D, testing and industrialization of equipment, and (3) timely deployment, requires a new way of coordinated thinking: "end-to-end planning" has to be supported by a well organized and coordinated organizational structure involving different DGs and even extending beyond the EU. This was not the case for Mine Action, but appears today to be the case for Environmental Risk Management.

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Table of Contents

1 INTRODUCTION 3

1.1 DOCUMENT OVERVIEW 3
1.2 APPLICABLE AND MAIN REFERENCE DOCUMENTS 3

2 COUNTRY LEVEL AND EUROPEAN ANALYSIS 3

2.1 GERMANY - OVERALL ANALYSIS 3
2.2 UNITED KINGDOM - OVERALL ANALYSIS 3
2.3 THE NETHERLANDS - OVERALL ANALYSIS 3
2.4 BELGIUM - OVERALL ANALYSIS 3
2.5 EUROPEAN UNION - OVERALL ANALYSIS 3
2.6 JAPAN - OVERALL ANALYSIS 3

3 BOTTLENECKS 3

3.1 CONFIDENCE 3
3.2 COST 3
3.3 COMMUNICATION 3
3.4 OTHER FACTORS 3

4 LESSONS LEARNED 3

4.1 COST 3
4.2 TEST & EVALUATION 3
4.2.1 Overview 3
4.2.2 Test and Evaluation Program for Humanitarian Demining (ITEP) 3
4.3 CONTRIBUTIONS AT EUROPEAN LEVEL 3
4.3.1 EC Funding Instruments and their use 3
4.3.2 Direct results and Spin-offs to other domains 3
4.3.3 Summary 3
4.4 WHAT COULD HAVE BEEN DONE AT EUROPEAN LEVEL & CONCLUSIONS 3
4.4.1 Overall considerations 3
4.4.2 EC Funding Instruments and their use 3
4.4.3 European R&D projects 3

5 CONCLUSIONS 3

6 BIBLIOGRAPHY 3

6.1 MAIN REFERENCES 3
6.2 OTHER RELEVANT REFERENCES 3
6.3 SELECTED LIST OF LINKS 3

7 ANNEX A - ENVIRONMENTAL RISK MANAGEMENT - EC REGULATION 3

8 ANNEX B - ENVIRONMENTAL RISK MANAGEMENT - EC SERVICES 3

9 ANNEX C - ENVIRONMENTAL RISK MANAGEMENT - FP6 CALLS 3

10 ANNEX D - ENVIRONMENTAL RISK MANAGEMENT - MAIN FUNDED PROJECTS 3

11 ANNEX E - TECHNOLOGY READINESS LEVELS OVERVIEW 3

Index of Figures

FIGURE 1-1 "CONFIDENCE-COST-COMMUNICATION" GAP-TO-MARKET MODEL 3
FIGURE 4-1 ITEP TIMELINE 3
FIGURE 7-1 EC ENVIRONMENTAL RISK MANAGEMENT REGULATORY TIMELINE 3

Index of Tables

TABLE 1-1 APPLICABLE DOCUMENTS 3
TABLE 1-2 MAIN REFERENCE DOCUMENTS 3
TABLE 4-1 ACRONYMS USED IN TABLE 4-2 3
TABLE 4-2 EUROPEAN R&D FUNDING SCHEMES USED FOR HD RTD RELATED ACTIVITIES 3
TABLE 4-3 EC FUNDING INSTRUMENTS UNDER FP7 AND THEIR USE 3
TABLE 4-4 SPIN-OFFS OF EC CO-FUNDED RTD PROJECTS TO OTHER DOMAINS 3
TABLE 8-1 EC SERVICES DEALING WITH ENVIRONMENTAL RISK MANAGEMENT (SOURCE: EC WEBSITES) 3
TABLE 8-2 SPECIAL RTD INITIATIVES DEALING WITH ENVIRONMENTAL RISK MANAGEMENT 3
TABLE 9-1 ENVIRONMENTAL RISK MANAGEMENT FP6 CALLS 3
TABLE 10-1 ENVIRONMENTAL RISK MANAGEMENT – MAIN FUNDED EUROPEAN PROJECTS 3
TABLE 11-1 TECHNOLOGY READINESS LEVELS TABLE (SOURCE [MAN1995]) 3

1 INTRODUCTION

1.1 Document Overview

Based on the assessment of the Humanitarian Demining RTD situation from early 1990 until today, summarized in D4.1 "Humanitarian Demining R&D Project Funding in Europe", this document analyzes the bottlenecks in the transfer of technology from technology development to the use in the field, and draws some lessons learned.

Four European countries (Belgium, Germany, The Netherlands and the United Kingdom) were selected, together with Japan. The situation at European level was also analysed, with emphasis on activities sponsored by the European Commission.

The study team have taken a number of approaches in carrying out this analysis. The team started from the existing body of literature and contacts accumulated from its extensive participation to European and national R&D programmes in the past decade, complemented where necessary with targeted literature surveys (documents, databases, and internet search). A number of direct contacts and where appropriate interviews were used for the selected countries, both to compile the detailed descriptions of the most important national activities, and to complement our analysis. Representative events, organisations and projects were selected rather than seeking to be exhaustive.

The developments in Humanitarian Demining (HD) during the last 10 years, as provided in D4.1, underline the fact that in a number of cases demining related developments have been terminated or at least put on hold. This is usually due to a combination of factors (bottlenecks - Figure 1-1) which can be broadly classified as either (i) Confidence, (ii) Cost, or (iii) Communication related.

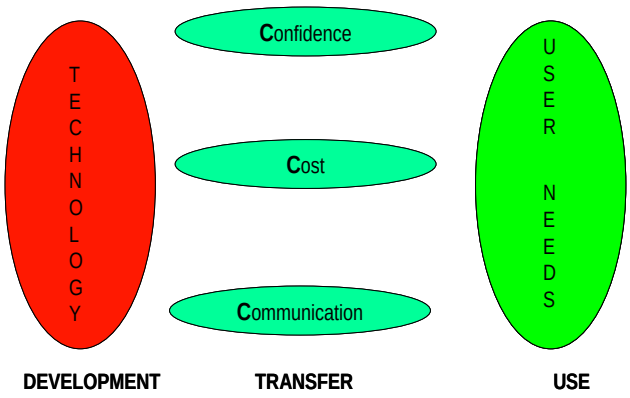

Figure 1-1 "Confidence-Cost-Communication" Gap-to-market Model

This document examines these bottlenecks following the country level and European analysis provided in D4.1.

Moreover, given that Humanitarian Demining RTD has been progressively incorporated within the broader "Improving Risk Management" strategic objectives of EC DG INFSO, the team did also examine in detail the development of regulatory policy surrounding Environmental Risk Management, and cross-referenced this to the development of Research and Innovation policy during FP6 and FP7 and the launch of targeted initiatives such as INSPIRE, GMES and GEOSS.

This document is structured as follows:

- **Section 2** Summarizes the overall analysis at country and European level.
- **Section 3** Discusses the *Confidence*, *Cost* & *Communication* bottlenecks.
- **Section 4** Summarizes the lessons learned from Humanitarian Demining RTD.
- **Section 5** Draws some conclusions.
- **Section 6** Lists the main used bibliography.
- **Annex-A** Summarizes the main EC regulations with respect to Environmental Risk Management.
- **Annex-B** Presents the main EC services dealing with Environmental Risk Management.
- **Annex-C** Lists the main FP6 calls related to Environmental Risk Management.
- **Annex-D** Lists the main projects funded in Environmental Risk Management at EC level.
- **Annex-E** Lists the Technology Readiness Levels definitions used in this document.

1.2 Applicable and Main Reference Documents

[DoW]	Description of Work. EC IST, ***DELVE***,
[RevDoW]	Revised Description of Work. EC IST, ***DELVE***,
[D3.1]	Organizational Aspects Intermediate Report
[D4.1]	Humanitarian Demining R&D Project Funding in Europe

Table 1-1 Applicable documents

[BRU2006]	C. Bruschini, H. Sahli, A. Carruthers, "Guidebook on Detection Technologies and Systems for Humanitarian Demining", Geneva International Centre for Humanitarian Demining, ISBN 2-88487-045-8, Geneva (2006). www.gichd.ch and http://www.gichd.ch/1248.0.html
[GAS2005]	R. Gasser, R. Keeley, "Global Assessment of EC Mine Policy and Actions 2002-2004", Framework Contract: EUROPEAID/116548/C/SV, LOT Number 4 Mission number 2004/89069 - Version 2, March 2005. http://ec.europa.eu/europeaid/projects/mines/global_assessment_final.pdf
[GAS2004]	R. Gasser, "EC research and the deployment gap", presentation at the EUDEM2 Final Workshop, 5/10/2004, Brussels. http://www.eudem.vub.ac.be/eudem2_final_workshop_programme.htm
[GAS2003]	R. Gasser, "Report on Expert Panel Meeting on Humanitarian Demining RTD", Brussels, 20/3/2003, unpublished.
[EC2003]	"Humanitarian Demining Research and Technological Development funded by the European Commission", Brochure, European Commission, Publication EUR 20830, ISBN 92-894-5942-5, 2003. http://serac.jrc.it/publications/pdf/demining_no_sig_en.pdf
[COR2004]	J. Cornelis, H. Sahli, "International Conference Assembles Military Considerations within Mine Action Technology Trends", Journal of Mine Action, Issue 8.1, June (2004), p. 63. http://maic.jmu.edu/.
[COR2003]	J. Cornelis, H. Sahli, "International Conference on Requirements and Technologies for the Detection, Removal and Neutralization of Landmines and UXO" (EUDEM2-SCOT 2003 - VUB, Brussels, 15-18 September 2003) - Trends, generic conclusions, open questions, 12/12/2003. http://www.eudem.vub.ac.be/eudem2-scot/
[COR2000]	J. Cornelis, A. Craib, R. Voles, "Strategic Study of the Humanitarian Demining Prospects - The role of RT&D analysed as a Europe-wide issue", 30/5/2000. http://www.eudem.vub.ac.be/publications/Files/StrategicStudy.pdf

Table 1-2 Main reference documents

2 COUNTRY LEVEL AND EUROPEAN ANALYSIS

The lack of an overall, coherent strategy resulted at European level – apart from the large EC sponsored effort – in each country basically following a different approach towards Humanitarian Demining R&D (**fragmentation** of European research scenario), when any structured approach could be identified, in some cases even with a lack of information and coordination between national instances[1]:

- Some countries relied mostly on defence services to carry out HD related R&D (e.g. Sweden, or The Netherlands),
- others implemented genuinely civilian efforts (e.g. Belgium, or Germany with its Humin/MD programme),
- whereas others dedicated little effort to the HD component and pursued mostly military developments (e.g. France).

It also resulted in some research topics being quite well covered, such as GPR or multi-sensor data fusion, while others, such as R&D on mechanical equipment or on trace explosive detection, which appeared to be an area with potential for a breakthrough technology, being neglected. Funding sources have been quite diverse, ranging from European to defence budgets, from general research funds to (more rarely) development aid agencies.

2.1 Germany - Overall analysis

The German demining R&D situation seems to be characterised by the following factors:

- There is no single leading personality/driving force, nor a unique trend in activities.
- There does not seem to be, in what concerns demining oriented R&D, a tight coordination between the different federal entities involved, the DfG (German Research Foundation), and the major German research institutions[2] and research funding organizations.
- There is clear industrial involvement for some applications.
- One scientific project stands our in particular – the BMBF sponsored Humin/MD – with a clear focus on MD enhancement. This project started relatively late (compared to all major R&D efforts, excepted Japan). Results will be made fully available to the equipment manufacturers, which will have to decide on their own if and how to pick them up.
- Large military national product development lines (MMSR, AAMIS) were much more attractive to industry than European projects ("normal" R&D contracts, i.e. 100% funding rather than cost-shared, selected subcontractors, clear customer, and well defined requirements). In this respect, some industrial organisations did clearly state that they would not have pursued this type of activity had they not received full funding.
- At the military level, airborne minefield detection has been attempted for a very long time, but is now discontinued. Several landmine detection/confirmation projects were also launched over the years (seismo-acoustic, gamma-ray backscatter, etc.). Most resources are now concentrated in the MMSR-SYDERA vehicle based clearance and detection system.
- The long lead times of projects such as MMSR (10 years between the MMSR start and the availability of the MMSR-SYDERA functional demonstrator, which is still quite far from deployment) are illustrative of the complexity of the task at hand.

[1] At military level, national R&D programmes were encouraged to focus on complementary expertise instead of competing on all aspects of a given activity [EC2001].

[2] Fraunhofer Society, Hermann von Helmholtz Association of National Research Centers, Leibniz Association, Max Planck Society for the Advancement of Science, and Alexander von Humboldt Foundation.

- Like in a number of other countries, as well as at European level, security related R&D has seen an ever increasing interest (see the "1st Call of national security programme" in the timeline).

2.2 United Kingdom - Overall analysis

The demining R&D situation in the UK seems to be characterised by the following factors:

- No drive from the industry (apart from ERA & EMRAD/Pipehawk).
- The UK has a "national" problem with landmines (Falkland Islands, a British Overseas Territory), which it tried to tackle quite early (ERA GPR Falkland tests in the early '80s).
- UK companies (ERA and EMRAD/Pipehawk) had access to the Falkland experience before entering European projects.
- British NGO's were the first to enter mine action.
- The very long lead-time between the first Falkland test and the ITEP field tests are illustrative of the complexity of the task at hand.
- Some R&D activities were boosted by DFID (e.g. via its procurement call of 1999, or T&E support, as detailed in D4.1).

Further details on ERA are available in the "Success case studies" section of D4.1.

2.3 The Netherlands - Overall analysis

The Dutch demining R&D situation seems to be characterised by the following factors:

- No drive from the industry.
- The existence of the HOM2000 project and the Airborne Minefield Detection Pilot Project gave visibility to the topic and provided the necessary momentum to work in European projects.
- The HOM2000 project suffered from over-optimistic expectations and insufficient contact with end users in the field.
- No priority in external communications existed during in the early product-development phases of HOM2000.
- Follow-up activities: smaller projects, more focused to direct practical impact, with strong interaction with end users in the field.

The main results of this R&D activity can be summarised as follows:

- Polarized camera (see case study in D4.1).
- GPR array triggered by, but in parallel to HOM2000 (see case study in D4.1).
- ITEP involvement.
- Setting up and participation to the EC GEODE / LOTUS / ARC projects.
- TNO outdoor test facilities for controlled environment and soil conditions.
- Spin-offs to security/ IED (Improvised Explosive Devices) detection applications.
- Early ITC activity triggered the REMIND (Remote Minefield Detection) EEIG on airborne survey.

2.4 Belgium - Overall analysis

The demining R&D situation in Belgium seems to be characterised by the following factors:

- Early involvement in Humanitarian Demining related R&D (activities started in 1996).
- The availability of a large national research project (HUDEM) for universities facilitated understanding of the problem and allowed participation to European projects by providing early visibility. However, the national HUDEM project suffered from no defined objectives in terms of end-to-end planning.
- The participation of the most active institutions at R&D level, namely the RMA (Royal Military Academy) and the VUB (Vrije Universiteit Brussel), shares the following characteristics:
  - Presence of institutions visible throughout the whole process.
  - Clear synergies between HD research and "natural in-house research".
  - Used to work with a multi-disciplinary approach.
  - Externally oriented structures, open towards the R&D community.
  - Exploitation of a wide range of funding sources (Internal, National and EC).
  - Use of EC support measures to accompany R&D efforts (e.g. EUDEM, EUDEM2).
  - Drive towards field tests (minefield/test facilities).
- The APOPO rat detection programme, financed by the Ministry of Foreign Affairs, was clearly field oriented.
- No national industrial commitment.

2.5 European Union - Overall analysis

The demining R&D situation in the European Union seems to be characterised by the following factors:

- **A number of R&D projects** have been launched over the years (see summary table below), following a clear political drive (see for example the EP resolutions, or the initial interest in the problem by EP members, which subsequently visited JRC and triggered the JRC 1994 workshop). Initial tenders have been gradually replaced by "traditional" FP calls, with a few exceptions such as the Airborne Minefield Detection Pilot Project co-financed by DG Development. The European timeline in D4.1 does also clearly show the time lag between the decisions and their actual implementation, as well as the different "waves" of European projects.

July 1996	EC DG 1A multi-sensor tender issued
June 1997	EC HPCN HD tender 1997*
March 1998	EC FP4 R&D HD main call issued***
May 1998	EC HPCN HD tender 1998 issued**
February 2000	EC FP5 HD R&D main call issued****
October 2003	EC FP6 "Improving Risk Management" call closes

- The **market issue** in Humanitarian Demining was recognised at European level at least as early as 1997 (EC "Industrial Requirements for HD" workshop) [EC1997].

- While **Mine Action** as a focus is still well present on the European agenda, **security** and **risk management** issues did gradually eclipse Humanitarian Demining RTD: conferences started to address both HD and security, the PASR initiative was launched in 2004, the FP7 security call at the end of 2006, while HD disappeared from the environmental risk management agenda.
- **European scientific conferences** were mostly unique events, without an overall planning. This is in contrast to the US, where an annual conference takes place ("Detection and Remediation Technologies for Mines and Minelike Targets", organised by SPIE[3]). European events were however often ***truly*** Humanitarian Demining oriented, whereas the US ones are heavily influenced by defence sponsored work[4], and partially suffer a lack of end user input.
- **The complexity of the task at hand** is again illustrated by the distance in time between the 1994 UN/FOA conference in Sweden, where it was hoped that a GPR solution was only 5 years away, and the actual ITEP field tests of dual sensor systems, or between the start of the work on the Bofors artificial nose (biosensor) in 1995 and the BIOSENS field tests of 2002-2004.

2.6 Japan - Overall analysis

The Japanese Humanitarian Demining R&D situation is quite unique, being characterised by a concerted effort in which three different ministries participated. The relatively late start (2002), compared to other countries, did probably not help the technologies which have a long lead time, such as the explosive detection one (nuclear and NQR). Full details of the projects are reported in D4.1.

Success factors: Concentrating on the sensor specific part of the project, we can say that the project has been a success in the sense that:

- It has been possible, by a concerted effort, to bring a number of systems to the field test phase, to scientifically evaluate their detection performance comparing it with currently used metal detectors, and to publish the results.
- Three dual-sensor systems were tested under the use of local deminers in Cambodia.
- ALIS will undergo a comparative test by ITEP, in Croatia during Sept. 2007, together with HSTAMIDS (US) and MINEHOUND (UK/Germany). ALIS also underwent validation test in Croatia and Egypt.
- A pre-production version of ALIS will be available at the end of the JST project.
- Scientists have got a good feeling for the actual field conditions.

Actual deployment: It comes as no surprise that actual system deployment has been more successful for the mechanical systems than for sensor equipment.

Concerning the ALIS system in particular, time will tell if its imaging approach will stand a chance compared to the acoustic feedback approach of the competing HSTAMIDS and MINEHOUND systems, which are likely to have profited from more extensive financial backup and longer development time.

[3] Actually an UXO-Countermine event is also hold in the US (bi-annual), with the SPIE one being more scientifically oriented.

[4] And US MoD sponsored University research in this field is obliged to report at SPIE.

3 BOTTLENECKS

The single most important bottleneck in Humanitarian Demining related R&D was probably, as already hinted at, the **lack of an overall, coherent strategy** (see also [COR2000] for a thorough discussion of end-to-end planning and a number of suggestions). This was partly unavoidable due to the very nature of R&D, the large number of stakeholders involved, and conflicting interests – full coherence would admittedly have been very difficult to implement in practice.

In the following we will review a number of other key bottlenecks according to the "Confidence-Cost-Communication" classification defined in Section 1.1, and provide some suggestions on how they could have been, or can be, overcome.

3.1 Confidence

Building end-user confidence in technology:

Confidence in new technology has to be built up. Technology demonstrated only in controlled test environments is not very convincing, although tests under such conditions are necessary and can be part of the confidence building process.

This (perfectly understandable) attitude towards new technologies is also observed in other professions (e.g. health care and medicine), where fast and critical decisions need to be made. It can partly be explained by a preference to use an imperfect technique whose limitations are well-known as compared to a new technique with better performances that is not fully trusted yet [EUDEM1999].

Confidence is however not always based on scientifically proven data. During the EUDEM2-SCOT 2003 conference first results were presented on rigorous testing of well accepted HD techniques – metal detectors and prodders – which showed much less than 100% detection rates[5] [COR2003]. New technologies with similar non-perfect test results will not be accepted for field use, and perhaps not even fully tried out in practice, which illustrates that confidence is essential for the end user.

Possible remedy: Rather than trying to replace technology currently in use one should try to operate in parallel and show the benefits of the new technology to the user. This is for example done by several hand-held multi-sensor systems developers (MINEHOUND and HSTAMIDS). Detailed and interesting analysis in cost-benefit in terms of use of new technology is given in [KEE2006].

Standard Operating Procedures (SOPs):

SOPs are intimately related to Humanitarian Demining. New equipment will usually not fit in the existing SOPs.

Possible remedy: Develop new SOPs step-by-step together with the end user. This goes together with building confidence. So far, the use of IMAS by technology developers has been limited.

[5] And it is interesting to note that this has likely biased R&D of some sensor systems by imposing on them excessive performance expectations.

3.2 Cost

Level of cost trade-off[6]:

The level at which financial decisions are made is of key importance. At local level the decisions will be different than at national or even international level. For example, contracts for demining operations tend to be too small, and possibly non-renewable, to justify significant investment in technical equipment by a demining organisation (see also [GAS2005]).

Possible remedies: One possible strategy consists in combining budgets at a sufficiently high (international) level to allow the development and fielding of technology. The trade-off should then be made between the cost of the technology and the savings made in operations due to higher demining productivity. In other words, the cost of research on demining in technology should be compared to the potential cost reduction of the use of this technology worldwide. Donors for technology research and donors for actual demining are usually not the same[7]; this cost-benefit analysis is therefore hardly ever made[8].

At end user level, larger demining projects should be supported or, if not possible, other methods devised to ensure continuity of operations, in order to enable long term investment in technology.

Cost of product development / Lack of financial continuity:

Many of the projects aimed at the development of demining technology resulted in a demonstration of a proof of concept or a demonstration system (some did not even reach this level). Further product development, which is well-known to often cost much more than the initial demonstration or proof of concept stage, and which has to include a) a rigorous and expensive test and evaluation phase allowing to reach confidence in this safety-critical application, and b) turning a laboratory prototype into rugged and reliable equipment suitable for use in harsh conditions, was hardly ever sponsored (no continuity of the post-R&D phases [COR2000], [EC2003]).

This **finance gap** ("death valley") between R&D and field-ready technologies has been well-known over the years, and was already specifically discussed at EC level in 1997 [EC1997], and possibly even earlier. However, due to the EC R&D funding constraints (pre-competitive R&D only as a consequence of the laws on competition[9] – support cannot be given to turn a working prototype into a commercial production item [GAS2005]), it was in practice impossible to overcome it at EC level. In other words, "No structural support exists in Europe for carrying the results of EC funded R&D projects towards fieldable systems" [COR2003].

Possible remedies: In retrospective it might have helped to find ways to select a few systems and carry them through the full development cycle, similarly to what done in certain military procurement processes.

The concept of a supranational Equipment Procurement Agency, acquiring, organising and maintaining a *central pool of equipment* (technical toolbox), which could be called upon by the deminers following e.g. a leasing formula, was also discussed as the basis of a solution to meet the market requirements [EUDEM1999]. This type of agency did however never see the light. Other suggestions on new mechanisms to take technology from RTD&D through to production and deployment, involving competitive trials and a defined procurement plan for successful equipment without breaking competition laws, were proposed in [COR2000].

[6] The level at which a decision to run the risk of early R&D investment vs. later recovery is taken.

[7] Exceptions have occurred, for example DFID in the UK support R&D projects, and the German Federal Foreign Office supporting T&E activities.

[8] This results in the well known accusation that money spent on technology research is wasted, whereas having spent the same amount on demining operations using conventional tools would have resulted in the clearance of extra square metres.

[9] It has been claimed that the interpretation of these laws is too strict [COR2003].

Absence of a commercial market:

It has become clear in the past years that the market for Humanitarian Demining sensing technologies and systems is nowhere as large as initially assumed[10], and fragmented. Other markets, such as security and environmental risk management, are likely to draw the largest share of the sensing equipment developers' attention, together with military mine clearance, where investments are likely to continue to be relevant in the years to come [BRU2006]. This is coupled to the "uncertainty of the prospective sales volume," – which can depend heavily on unpredictable political priorities – "the extensive and expensive trials required to prove the performance achieved, and the very real risk that these trials will fail to confirm the original expectations of the user (deminer) community" [COR2000].

All these factors do obviously worsen the previously described product development cost bottleneck, and imply that the business case for industrial investment is very poor (see also [EC2003], [GUI2002], [COR2000]).

Possible remedies: Some possible strategies have already been presented in the previous section.

"Spin-offs" from HD to other markets (i.e. search for non-demining applications for the technologies being developed) were also considered. The most important ones seem nowadays to be security, environmental risk management and military demining.

This has apparently been attractive enough to motivate a number of European organisations to participate in cost-shared projects (see also the "spin-offs" summary table in Section 4.3.2), although it is admittedly difficult to analyse *a posteriori* the real importance of the spin-off factor. Whether this is sufficient to cover the costs of HD specific developments remains therefore an open issue. Indeed, exploiting dual use opportunities might not be that straightforward, as for certain applications a substantial amount of re-engineering is required.

3.3 Communication

Communication with national initiatives at the basic research level:

In a number of cases, with the notable exception of Belgium and The Netherlands, there has been a considerable lack of communication between European R&D projects and national research initiatives dealing with similar aspects.

Communication between R&D projects (past and present):

It is acknowledged that increasing the communication between competing projects is difficult, and not only when there are clear commercial interest. Ways should nevertheless be found to make a project's results more visible. Lack of communication between projects in high visibility domains such as Humanitarian Demining can be difficult to understand for the end users and the general public.

Unfortunately the fact that Humanitarian Demining related European scientific conferences were mostly unique events, without an overall planning, did not help.

Ways should also be found to make sure that a starting project is really aware of the state-of-the-art and has fully understood it (in retrospective this was not always the case for the European Humanitarian Demining projects), including the results of the forerunning projects.

[10] In [EC2003] the world-wide market for Humanitarian Demining equipment was estimated to be about 20 M€ per year.

Possible remedy: Mandatory publishing of short summaries, or well structured and content-rich websites, and possibly of the main results as well. Encourage participation at selected events, e.g. "cluster" meetings (see for example [EC2001] and [EC2002]), or networking opportunities across ICT topics. Ideally there would also be a clear and effective knowledge transfer between a starting project and those in the same domain having already completed.

Information circulation:

The right amount and the right type of information should circulate between all concerned key actors. There is for example *little available documentation which specifically demonstrates the linkages between regulatory policy, research calls for proposals, and end-users*. These are generally viewed as separate issues that are the responsibility of separate services (e.g. DG Environment, DG Development, DG Research and DG Information Society and Media). Whenever there may be an overlap of interests, these are normally subject to discussions at Inter-service consultation meetings. The minutes of Inter-service consultation meetings are generally not made available beyond the Commission, except in certain cases where public consultation is sought through representative bodies.

Possible remedies: Coordination and support initiative can be very helpful in providing for example:

- Overall high level mapping of the R&D scene (key actors, projects, solutions, resources).
- Collection of Conference Announcements and Conference reports (for the benefits of those who have been unable to attend, or who would like to attend a similar event in the future), Newsletters (key results or publications).
- Interviews with key actors, including end users on field work related issues.
- Lessons Learned databases.
- Research/Field Users: Convince field users to release more information on the research they have carried or are carrying out, which is often more valuable than what they might think.
- Organigrams (*Organisations Charts*)[11]: Detailing "Who's Who" in the community.

This is far from straightforward and requires an important coordination effort, likely over a number of years, and appropriate means, as well as a strong pro-active attitude. According to past experience, "*A strong will, a clear mandate and vision, and the necessary resources are a must for an activity like this*" [EUDEM2_2004].

Basic understanding of the problem and clear problem overview:

It might seem obvious that a problem has to be well described and understood before it can be tackled, but this was not the case at the beginning for Humanitarian Demining. Reasons are the lack of communication between the end users and the technology developers, the fact that the demining one is still a relatively young industry, and the initial difficulty of the demining community in coming up with clear scenario definitions.

As an example, area reduction (rather than the detection of individual mines), a topic where large gains in demining efficiency can be achieved, was indeed tackled early in 1998 through the DG Development co-financed Airborne Minefield Detection Pilot Project, but reinforced only relatively late in 2002 by the DG INFSO through the ARC and SMART projects. The same is true for ICT, such as information management and decision support systems (e.g. IMSMA — Information Management System for Mine Action), human-machine interfaces, or positioning systems, vs. sensing technologies (see also [EUDEM1999], [EC2001], [EC2002], [EUDEM2_2003a] and the conclusions in [GAS2003]). In addition, there might very well have been room for smaller projects, aimed at incremental improvements and adaptations of existing technology (e.g. Metal Detectors, training aids, or Quality Assurance).

[11] Graphic chart showing the directorates/units/departments, lines of authority, control responsibility and vertical and horizontal interrelationships among the directorates/units/departments in an organization, institution, community, ...

Also, parameters such as equipment robustness, ease of use, cost and operating costs, and operator instruction level, have not always been considered in the R&D projects from the very beginning.

Possible remedy: To increase the understanding of the requirements it is sometimes very useful to have a set of scenarios. These scenarios should be defined with strong input from demining organisations and also agreed by them. The scenarios should provide a description of the operational concept detailing how the technique or technology will eventually be applied by the end user. Based on the scenarios and operational concept descriptions the actual requirements can be derived, taking into account both the problems and the boundary conditions imposed by the use in the field and the technical limitations for the specific technological solution. It is therefore obvious that the technical requirements should be derived in a co-operative effort between end-users and technology developers.

However, although scenarios are considered very useful, it will be impossible to cover all possible conditions of use of HD equipment in a set of scenarios no matter how large the set is chosen.

Communication to stake holders:

Competing projects: The presence of similar projects is part of a natural process in R&D, at least during the initial development stages, but can be difficult to explain to the end users and the general public in high visibility domains such as Humanitarian Demining, and therefore be subject to public pressure and criticism.

Basic research versus Product development: It is a fact that the lead times of some R&D sensing technologies can be very long (GPR, trace explosive detection, smart metal detector). It might be tempting to announce technical breakthroughs, but this should be done with great care. Over-exposure of immature technology has done a lot of harm in the communication between researchers and end users.

Possible remedy: The maturity of the development should always be clearly stated. A common method for indicating the maturity of technology is the Technology Readiness Level (TRL) scale[12], which ranges from 1 to 9 [MAN1995].

Exchange on technical topics at the right level between researchers and deminers:

A critical factor in the process of defining the product goal in a product development process is that the technical representative of the Humanitarian Demining organisation is able to understand the potential of the technique and that at the same time the researcher can understand the operational requirements. An example is illustrated in the “Polarisation camera” work spin-off success case study in D4.1.

Possible remedy: Visits to demining operations and discussions with technical representatives from Humanitarian Demining organisations (during conferences like EUDEM2-SCOT or the EUDEM2 Final Workshop, field visits, or courses reserved for scientists and technicians) will facilitate this process. Joint events, e.g. those organised by NVESD in the US, do also represent interesting solutions.

[12] TRLs have been implemented in space and defence procurement programmes as a systematic scoring method to assess the development status of an individual technology and to compare it with other technologies. These scores also provide a basis for risk assessment and risk management.

Communication on sensitive issues (civilian-military):

In the particular case of Humanitarian Demining, communication between some civil research organisations and those active in the defence branch was not easy, in particular towards the beginning. This could also be the case in FP7 for security related issues.

[COR2000] identified the following three bottlenecks to a structured, shared military-civilian research:

- "New sensing principles for mine detection are mainly emerging from civil applications; globally there is *no net transfer anymore from military towards civilian world*.
- To a large extent, *useful military information stays classified* and not available for civilian usage.
- *In depth knowledge of newer sensing principles, allows for easy modification of mine designs*."

Possible remedy: [COR2000] argued for the establishment of a "code of conduct to agree mechanisms for transferring military R&D to humanitarian R&D". "Information sharing between publicly funded military- and civilian projects should be a bi-directional process" [EUDEM1999].

Communication on sensitive issues (IPR):

Similarly to the case of civilian-military interaction, communication with SMEs (e.g. the metal detector manufacturers in the case of Humanitarian Demining) was complicated by IPR issues. This can add considerably to the coordination difficulty.

Communication between different national initiatives:

Activities in military demining R&D were at some stage heavily fragmented across Europe, leading to the repetition of similar initiatives across many European countries (see also D4.1).

3.4 Other factors

Problem-specific scientific/technical bottlenecks:

Soil/environmental effects: We have already noted that landmine detection represents a formidable scientific and technical challenge, which is further complicated in a number of circumstances by soil and environmental effects. These were undoubtedly neglected at the beginning (see also the bibliographic R&D evolution study in D4.1).

Lack of common signature DB and corresponding user community: It was already noted in [EUDEM1999] that "To build a useful signature database is a major enterprise requiring a well-defined methodology and sufficient funding", complicated by a number of reasons such as IPR, or the fact that signal processing is highly dependent on the particular sensor implementation and the measurement conditions. And actually the mere existence of a signature DB is far from being sufficient to guarantee that it is indeed satisfactorily used (see the analysis in [MSMS2004]).

Multi-sensor fusion: In retrospective there has been as strong insistence on multi-sensor fusion (actually data fusion together with a multi-sensor system) when the individual sensors themselves had not reached a sufficient degree of maturity, neglecting somewhat R&D of single-sensor data processing and pattern recognition techniques for mine detection/classification (see also [EUDEM1999] and [GAS2005]).

R&D community:

We already commented on the necessity of assuring financial continuity to carry through R&D developments. The same argument applies to the efforts needed to keep an R&D community together. This is true for the Humanitarian Demining case as well, where the ramp-up time to build an R&D community was short, but funds did not allow, in several domains, to keep a critical mass together long enough to make a difference.

Competitive nature of European R&D projects[13]:

The competitive nature of EC sponsored R&D has the clear advantage of allowing fair access to funding resources, i.e. also for non established players. This can be compared to what usually happens in the defence sector, whose procurement cycle of projects with long lead times (e.g. the German MMSR) is often articulated over at least three phases of typical duration of three years each, and usually carried out by the same companies which started. It is clear that changing partners from one phase to another, as can happen for European projects, may not be optimal.

When in addition European R&D projects are short (say 3 years long) and the funding is spread over a number of partners, the risk that certain key activities do not reach the “threshold” which enables the project as a whole to fully succeed can increase.

The defence sector tends also, in particular where funds are limited and/or projects expensive, to bundle the available resources into very few projects, or even a single one.

[13] Compare also with the suggestions in [COR2000] on how to overcome the R&D deployment gap.

4 LESSONS LEARNED

In addition to the lessons learned related to the specific bottlenecks analysed so far, some more general lessons learned have also been extracted, as listed below:

4.1 Cost

Cost of product development / Absence of a commercial market

It is interesting to see that the FP7 security call text foresees the possibility, concerning the *collaborative project* funding scheme, that the Community funding may reach a maximum of 75% (instead of the customary 50%) in cases with very **limited market size** and a risk of "market failure" and for **accelerated equipment development** in response to new threats (*Art 33.1 Rules for participation*).

Realistic assessment of all costs

Development and trials costs, risks, timescales and return on investment are not always taken into account by consortia bidding for EC co-funded R&D projects. It was suggested in [COR2000] that any consortium should "present a proper justification of their proposal", including a realistic assessment of the previously mentioned factors, before receiving EC support. "These justifications should then be evaluated by relevant experts in much more depth than current practice allows. As the result of such evaluation there will often be the need for the proposal to be revised - and the current practices need to be amended to permit such iteration."

Relative benefits of new technology

Assessing the real benefits of a new technology should be done by means of appropriate tools, such as cost-effectiveness analysis. This is outside the scope of this report, and the interested reader is referred to [KEE2006] for details.

4.2 Test & Evaluation

4.2.1 Overview

Testing requires significant engineering competence and advance planning; it should not be considered as something to be done quickly towards the end of a project. There is a need to test the fundamental principles of new technologies as well as their implementation and suitability to form part of a Humanitarian Demining system for use in the field.

Requirements for test environments

Testing should follow an "incremental" model. One can identify at least four stages of testing: 1) laboratory, 2) partially realistic test areas, 3) real environment testing of prototypes, and 4) operational testing of equipment (see also [GAS2003]). The first three can be considered as "pre-competitive testing."

One can also distinguish different levels of control of the environment: 1) Indoor sandpits, 2) Outdoor lanes in well characterised soil and clutter conditions, 3) (army) Proving grounds, 4) In-country test lanes near actual mine fields, and 5) Live mine fields. All these test environments contribute to technology development during the total development time.

Demining test facilities have been built in several locations in Europe. Co-ordination of the development of these facilities to avoid unnecessary duplications could have yielded significant savings. In addition to the construction of the facilities, their maintenance represents a significant cost factor to be addressed. At the same time cheap access to a full range of facilities should be facilitated.

Under the FP6 call (DG RTD) for Integrated Infrastructure Initiatives a proposal was submitted by a group of organisations who run facilities for test and evaluation of technology for Humanitarian Demining (including among others TNO Netherlands, VUB Belgium and EC JRC in Ispra, Italy). Unfortunately the proposal was not sponsored. The proposal aimed at providing:

1) Access to Facilities and Instrumentation in order to provide researchers with free or nearly free access opportunities.
2) Analysis of technical and environmental factors influencing sensor performance, in order to co-ordinate potential further developments of the facilities and to avoid duplication in facilities.
3) Co-ordination of test protocols allowing to use the same protocol at all different facilities, thereby easing comparison of the results of tests carried out at different sites.

Sharing access to test-fields, sharing test protocols and disseminating test results should be encouraged by the Commission from the very beginning of the programme.

The role of end-users in testing is still not well defined. Field deminers clearly have a key role to play but may not be, without extensive training, the best people to assess a radically new technology, based on physical principles which they do not understand, and which has working methods which are new and unfamiliar. Further attention needs also to be paid to the careful design of realistic and meaningful assessment of equipment, especially when it uses new principles. Finally, the independence of testing must be guaranteed when the end-user is a member of the project consortium.

The role of ITEP in supporting Test and Evaluation activities is explained below. This section not only discusses the actual testing but also the outreach towards the end user. This is illustrated by the results of the ITEP programme.

4.2.2 Test and Evaluation Program for Humanitarian Demining (ITEP)

On July 17 2000 the Memorandum of Understanding for the International Test and Evaluation Program for Humanitarian Demining (ITEP) was signed by Belgium, Canada, the Netherlands, Sweden, the United Kingdom, the United States of America and the European Commission represented by JRC Ispra. Germany joined ITEP in 2002. The European Commission (JRC Ispra) discontinued its participation in 2006. The ITEP timeline is displayed in Figure 4-1.

Several of the ITEP nations had already successfully worked together in the IPPTC (International Pilot Project on Technical Co-operation) on the test and evaluation of commercial-off-the-shelf hand-held metal detectors.

The driving force of ITEP comes from the will of its members to achieve better conditions for Humanitarian Demining. Co-utilization of resources and expertise from participating ITEP countries allows allocated resources to be used more efficiently, thus contributing to the improvement of global Humanitarian Demining programs with a focus on demining technology. The ITEP website describes its mission and objective as [ITEPWeb]:

Mission

> "ITEP's mission is to develop standards, coordinate and perform tests of materials and methods, and spread information about the results to all other interested parties. ITEP will by this means contribute to the resolution of the global landmine problem through impacting the acquisition process towards better, safer, and more cost-effective equipment and methods."

Objective

> "ITEP's aim is to increase efforts within global demining through generating, collecting, and distributing objective, independent, scientifically based test and evaluation data on Humanitarian Demining materials, systems, and methods."

Structure [ITEPWeb]

No joint economic resources are established within ITEP. Each member funds its own activities, which may be entirely national or in co-operation with one or more other ITEP members. Another way to contribute to the program is for instance to make test facilities available for ITEP tests, even if the nation where the facilities are located is not directly involved in the project.

The management structure consists of a Board of Directors and an Executive Committee, wherein all decisions are taken by consensus.

The Board of Directors meets once a year. Each nation may appoint three directors. The Board of Directors takes decisions about ITEP policy and new members.

The Executive Committee meets twice a year and is composed of one representative from each member state. The Executive Committee takes operational decisions within ITEP. If the Executive Committee is unable to reach consensus, the matter has to be referred to the Board of Directors.

The ITEP Secretariat is the only common resource within ITEP. The Executive Committee manages the Secretariat. Each member state may assign an employee to the Secretariat.

The UN Mine Action Centre (UNMAS) and the Geneva International Centre for Humanitarian Demining (GICHD) are represented in the Board of Directors, the Executive Committee and the ITEP working groups. UNMAS and GICHD act as a channel of communication between the participants in ITEP and the end users.

Activities [ITEPWeb]

Through its members, ITEP constitutes a global network of test and evaluation resources for Humanitarian Demining. Activities within ITEP are as follows:

1. Develop and use universally accepted and respected standards for test and evaluation methodology.
2. Collect, generate, and distribute robust, scientifically objective data on technologies, materials, and systems for Humanitarian Demining.
3. Establish a responsive and cost-effective international test and evaluation program.
4. Perform tests and evaluation of:
    - Existing Humanitarian Demining equipment and systems,
    - Equipment and systems in development,
    - Promising technologies, processes, and algorithms.

Programme Description and Way of Operation

From the practical point of view ITEP is organised around its work programme, which provides an overview of the test and evaluation related projects performed by its members. Although systems under development may also be tested or evaluated in ITEP projects, ITEP itself has no joint development projects as such.

The work programme is updated with new projects on a yearly basis. During this update procedure the members also co-ordinate the opportunities to support each others projects by manpower or the use of facilities. The lead nation maintains the responsibility for the progress of a given project.

Projects are in the areas of Test and Evaluation of detection equipment, mechanical demining and test procedures. Each area is co-ordinated by a working group with representatives of the members active in this specific area of activities.

ITEP Results

Initially most projects were run by a single ITEP member with a relatively low interaction with other members. Over the years more and more projects became co-operations between members. The process of building trust between the members to co-operate in this manner has taken time. Decreases in budgets in the member nations have also accelerated the process towards co-operation. A multinational, scientific and technological partnership for Humanitarian Demining has thus been created through ITEP.

Over the lifetime of ITEP since the year 2000 many common projects have been successfully completed. The corresponding results (and reports) are published on the website. Although not all the projects have been reported in the same level of detail, the ITEP website contains a large set of good quality test reports (some of the limitations in reporting are due to commercial or IPR (intellectual property rights) issues). Notable ITEP results include:

- ***Standardisation of the evaluation of Metal Detectors***
  Starting from the pre-ITEP IPPTC (International Pilot Project on International Co-operation) initiative on the evaluation of metal detectors, the following sequence of events took place. The IPPTC itself was basically a test of commercial-off–the-shelf Metal Detectors; the systems were tested in lab conditions (DRDC Canada), outdoor test lanes (TNO Netherlands), and field conditions (Cambodia, Croatia).

  From these tests the need for common test procedures became apparent. ITEP then requested the Joint Research Centre of the EC to initiate the CEN Workshop on Humanitarian Mine Action – Test and evaluation – Metal Detectors. This has led to the CEN workshop agreement CWA 14747 in June 2003 [CEN2003].

  In the STEMD (Systematic Test and Evaluation of Metal Detectors) project the procedures from this CWA were applied to actual field tests in Lao and Mozambique. Based on the experiences in STEMD (and other MD evaluation projects) the wish to update the CWA 14747 emerged.

  This has led to a new CEN workshop with the intention to readdress the CWA 14747. The main part will remain, but in addition soil characterization will be also be covered. The new agreement will also address how to apply or modify these test methods in field conditions and how to prioritise the tests in such conditions.

- ***Mechanical demining***
  After the first ITEP test on mechanical equipment started in 2002, the number of concurrent test projects rapidly increased. In 2004 10 projects on testing of mechanical equipment were included in the ITEP programme. In 2006 this number had further increased to 15. Canada and Sweden were particularly active in this area. ITEP provided a forum to co-ordinate these trials and to avoid duplications. ITEP also helped in the dissemination of the results by providing a forum to invite observers to the trials and by publishing the test reports.

- ***Hand held GPR-MD sensor evaluation***
  ITEP facilitated the evaluation of combined MD-GPR detectors. The first ITEP project in this field was the test at the NVESD ("Night Vision Laboratory") test lanes in the US, where the ERA and QinetiQ systems available at that time were assessed (2003). Experiences from these and other trials led to further development of one of the systems towards the MINEHOUND system, which has then been tested in three different countries over the period 2005-2006. A similar system of US origin (HSTAMIDS) has gone through a similar path of field evaluations between 2004 and 2006. Apart from the test results, the outreach to potential end users was an important factor in these trials. The ITEP community helped to establish the contacts needed to get NGOs involved. A real comparative test has been avoided so far, but the test results are available on the ITEP website.

Success factors

Link with end users. Participation in projects under the lead of other nations facilitates the extension of relations with demining organizations in the field and with other stakeholders.

No competition for budgets. The fact that each member is funding its own participation avoids competition for budgets. This facilitates real international co-operation and exchange of personnel, test facilities and equipment.

Publication of project reports on a website. A policy of open publication of test and evaluation reports on a website helps to avoid duplication in testing. The active role of the ITEP secretariat in pursuing the goal of publishing the reports of each project has definitely contributed to this.

Continuous interest from military end users. It is obvious that most of the tests on mechanical clearance equipment, but also on many other systems like the handheld MD-GPR systems, are also of interest for military users. This clearly helped to make the military test facilities available and to get support in manpower from several nations.

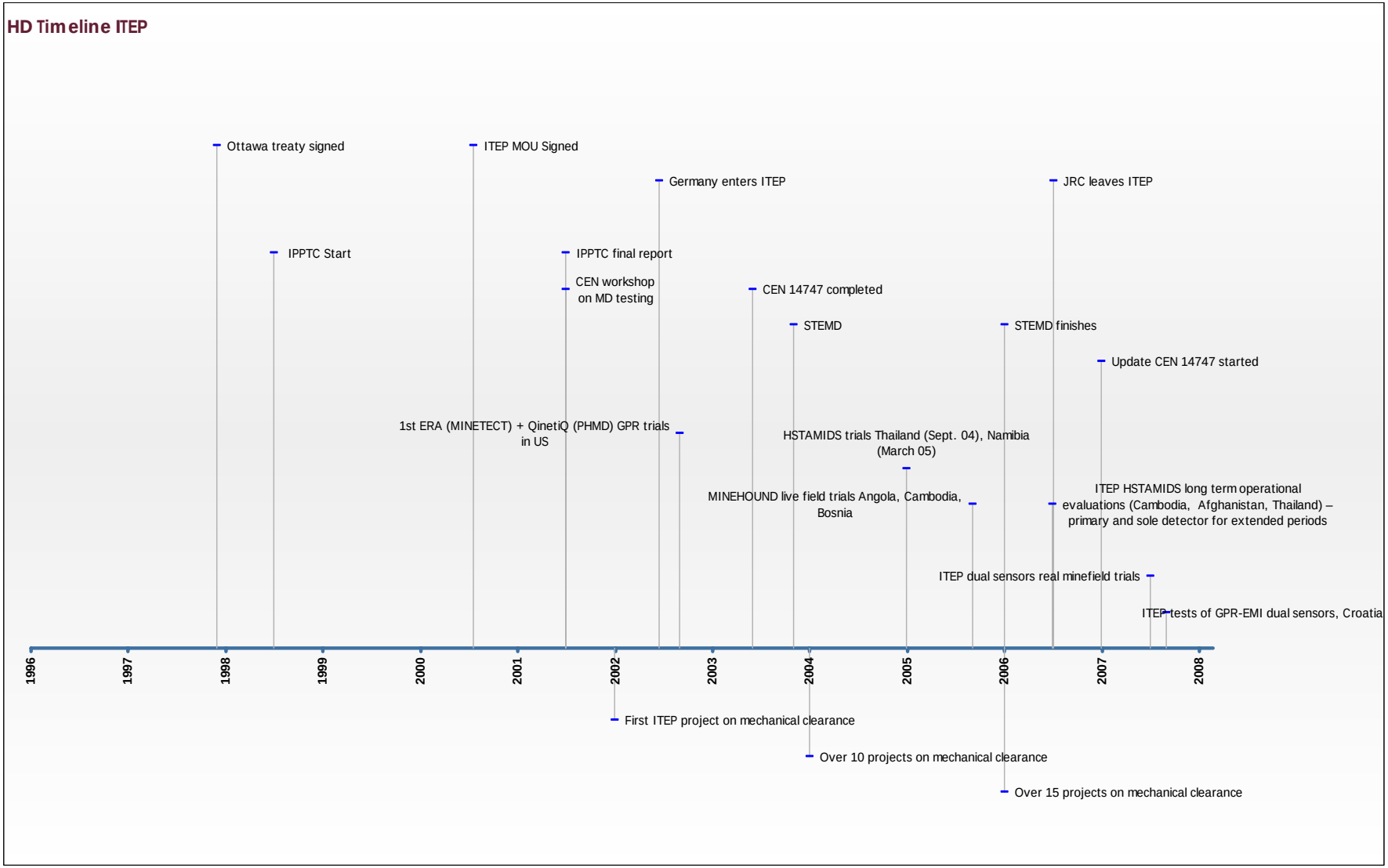

Figure 4-1 ITEP Timeline

4.3 Contributions at European Level

We will now briefly analyse the situation at the European level as a whole, with particular attention to the EC sponsored projects.

4.3.1 EC Funding Instruments and their use

Table 4-2 provides an overview of the European R&D funding schemes until FP6 and their application to HD related R&D, from basic research to pre-industrialisation. It employs the following acronyms:

AIDCO	EuropeAid Co-operation Office
COST	European Cooperation in the field of Scientific and Technical Research
CRAFT	Co-operative Research Projects (FP6)
CROMAC	Croatian Mine Action Centre
CW07	CEN Workshop 07
DG	(European Commission's) Directorate General
DG DEV	DG for Development
DG ECHO	DG Humanitarian Aid Office
DG INFSO	DG for the Information Society
DG RELEX	DG for External Relations
DG RTD	DG for Research and Technology Development
ECHO	European Community Humanitarian Aid Office
EOD	Explosive Ordnance Disposal
ERA	European Research Area
ERC	European Research Council
ESF	European Science Foundation
EUREKA	Europe-wide Network for Market Oriented Industrial R&D and Innovation
FET	Future and Emerging Technology (within DG INFSO)
IRC	Innovation Relay Centre
ISIS	Intelligent Systems for Humanitarian Geo-infrastructure project (FP5 IST support measure)
ITEP	International Test and Evaluation Programme
JRC	Joint Research Centre
MSMS	(European) Joint Multi-Sensor Mine Signature Measurement Campaign
NCP	National Contact Point
NEST	New and Emerging Science and Technology (FP6)
NoE	Network of Excellence
NMP	Nanosciences, Nanotechnologies, Materials and new Production Technologies (FP7, slightly different name in FP6)
RTN	Research Training Network (within Marie Curie)
SfP	Science for Peace (NATO R&D programme)
SME	Small- and Medium sized Enterprise

SSA	Specific Support Action
T&E	Test and Evaluation
TRL	Technology Readiness Level

Table 4-1 Acronyms used in Table 4-2

The "Achievable TRL" (Technology Readiness Level) column provides an indication of the typical TRL levels which can be covered by the funding instruments, and possibilities, detailed in the "Instruments" column to its right. Here we recall only that TRLs range from 1 which indicates the least ready for use — the basic physical principles have been noted and research can be started — to a score of 9 which indicates successful operational deployment (see also ANNEX E for details). It should also be noted that only projects which succeeded in attaining a TRL>5 have been used as examples in the "Test & Evaluation" row.

Individual projects and/or HD R&D activities which succeeded in making use of the funding instruments and possibilities shown in the "Instruments" column, are reported under "Examples".

The last column, "Other European opportunities", shows funding instruments outside the Framework Programme, providing when possible concrete example (EUREKA ANGEL project, NATO Science for Peace NQR explosive detection project, etc.).

From an analysis of the table one can deduce that only projects in the more product-oriented IST programme, as well as networking activities and support actions, have been exploited. Only a few projects involving other DGs, Offices and/or national initiatives have been set up.

Type of R&D and related activity	Result	Achievable TRL (typ.)	Instruments in FP6 & previous	Examples (demining or EOD related)	Other European opportunities
Fundamental (basic)		1-4	• FET Open, NEST (FP6) • Marie Curie (individual & RTN) • ERC (FP7)		• COST actions
Developmental (RTD) (identified field of application)	Demonstrator	4-7	• DG INFSO* • Other individual DGs** • ***Collaboration between DGs and Offices (AIDCO, DEV, ECHO, INFSO, RELEX, RTD) • NMP (DG RTD) • Co-operative (e.g. CRAFT)	• *Most IST HD projects • **European Airborne Minefield Detection Pilot Project (DG VIII + national governments); MINEDEMON GIS project (DG VIII). AIDCO support to APOPO rat detection project. *Note*: DG VIII is now DG DEV. • ***AIDCO mandate for CW07, AIDCO/ JRC administrative arrangement for T&E support, AIDCO support to GIS for Mine Action in South East Europe, ECHO support to IST ISIS project. • Indirectly via NMP projects on explosive detection.	• EUREKA (outside FP) -> ANGEL • NATO SfP -> NQR detection project
Applied (clear commercial goal)	Prototype	7-8	• Co-operative (e.g. CRAFT) including "low tech" R&D • Ideas proposed in [COR2000]		• EUREKA (outside FP)
Demonstration Activities			All EC R&D projects	Rarely used (low reimbursement rate)	
Networking opportunities, research coordination			• Conferences • Other within the FP • NoE • Education & training • ERA-NET (DG RTD)	• ESF Euroconference (Florence 1999) • FP6 "clusters" ([EC2001], [EC2002]) • ARIS NoE	
SME specific opportunities			• Co-operative (e.g. CRAFT)		
Support (not financial)			• SSA (FP6, FP5) • Calls for tender	• EUDEM2, DELVE • JRC support measures, JRC test facilities	• NCP • IRC
Test & Evaluation			• DG INFSO • Infrastructure call • DG JRC	• TRL>5: field tests of BIOSENS, ARC, SMART projects. • At least one proposal attempted (test facilities). • JRC test facilities and T&E activities (MSMS measurement campaign, participation in ITEP)	• National test facilities • ITEP

Table 4-2 European R&D funding schemes used for HD RTD related activities

To contrast with the previous table, we summarize in Table 4-3 the new EC mechanisms to promote implementation, industrialisation and applied commercialisation of R&D results. All of the instruments form part of the Research and Development funding chain which can be exploited by researchers and organisations who wish to contribute to and benefit from undertaking research in the field of Humanitarian Demining or more general Environmental Risk Management activities.

With respect to the Joint Technology Initiatives (JTIs) and the European Technology Platforms (ETPs), the key point in examining these instruments is to view them as complementary to the implementation of regulatory policy. Their creation as effective public-private partnerships under industry leadership with a dedicated Strategic Research Agenda (e.g. GMES) make them key players in **the integration of research activities and coordination of research and innovation policies**. They create a shared vision for the technologies concerned and define the necessary research and technical objectives for the medium-term in their key sectors. This agenda will be implemented under the banner of FP7 to maximise the effectiveness of public and private funding through a coordinated, complementary and collaborative approach for the benefit of the whole sector.

The new Competitiveness and Innovation Programme (CIP) and Risk Sharing Finance Facility (RSFF) will both be major assets in terms of consolidating research results efficiently and in a timely manner. The CIP and RSFF mechanisms are designed to support the process of innovation amongst researchers and industry by providing financial support to fast track the innovation process and bring research outputs closer to the market. These instruments will promote commercialisation and seek to change the culture, particularly in the research and SME communities, to make it an acceptable part of their activities, and to **make research outputs visible to the end user community as quickly as possible to ensure significant and effective uptake.**

As a result of these new initiatives, the European research landscape is making significant moves towards the development of an integrated support structure which streamlines the needs of regulatory policy, the research community, and the end user community.

EU Mechanism	Funding Mechanism	Description	Objectives	Examples
Joint Technology Initiatives (JTIs)	Under the FP7 Cooperation Specific Programme, public private partnerships in the form of JTIs may be set up funded by a combination of private sector investment and European public funding (e.g. Framework Programme and the European Investment Bank).	• Public Private Partnership with an appropriate legal, governance and management structure (avoiding conflicts of interest) • Implements the Integrated Strategic Research Agendas developed in the European Technology Platforms • Industrial leadership essential • Supporting a European Research Area (ERA); leveraging additional funds, private and public • Developing outreach at international level	• To leverage efforts in a more efficient way and with better focus to make sure technology will progress rapidly. • To set the frame for coherent research and deployment activities with clear commercialisation targets and avoid fragmentation of investment.	• Global Monitoring for Environment and Security (GMES) • Advisory Council for Aeronautics Research in Europe (ACARE) • European Hydrogen and Fuel Cell Technology Platform (HFE) • Innovative Medicines for Europe (IMI) • European Nanoelectronics Initiative Advisory Council 2020 (ENIAC) • Embedded Computing Systems (ARTEMIS) See also: http://cordis.europa.eu/fp7/cooperation/home_en.html#3
European Technology Platforms (ETPs)	Set up as part of FP7 new instruments to focus on strategic issues and growth priorities. There are now 31 ETPs (2007).	European Technology Platforms were set up as industry-led stakeholder forums, covering the whole economic value chain, to ensure that knowledge generated through research is transformed into technologies and processes, and ultimately products and services.	• To define research and development priorities, timeframes and action plans on strategically important issues over the medium to long term. • Play a key role in ensuring an adequate focus of research funding on areas with a high degree of industrial relevance, by covering the whole economic value chain and by mobilising public authorities at national and regional levels. • Address technological challenges that can potentially contribute to technological breakthroughs necessary to	• Advanced Engineering Materials and Technologies (EuMaT) • European Construction Technology Platform (ECTP) • European Rail Research Advisory Council (ERRAC) • European Road Transport Research Advisory Council (ERTRAC) • European Space Technology Platform (ESTP) • European Steel Technology Platform (ESTEP) • European Technology Platform on Smart Systems Integration (EPoSS) • Food for Life (Food) • Forest Based sector Technology Platform (Forestry) • Future Manufacturing Technologies (MANUFUTURE) • Future Textiles and Clothing (FTC) • Global Animal Health (GAH) • Industrial Safety ETP (IndustrialSafety) • Integral Satcom Initiative (ISI) • Mobile and Wireless Communications (eMobility) • Nanotechnologies for Medical Applications (NanoMed) • Networked and Electronic Media (NEM)

EU Mechanism	Funding Mechanism	Description	Objectives	Examples
			remain at the leading edge in high technology sectors and the restructuring of traditional industrial sectors.	• Networked European Software and Services Initiative (NESSI) • Photonics21 (Photonics) • Photovoltaics (Photovoltaics) • Plants for the future (Plants) • Robotics (EUROP) • Sustainable Chemistry (SusChem) • Water Supply and Sanitation Technology Platform (WSSTP) • Waterborne ETP (Waterborne) • Zero Emission Power Plants (Zep) See also: http://cordis.europa.eu/technology-platforms/home_en.html
Risk Sharing Finance Facility (RSFF)	The RSFF is a joint initiative of the European Commission and the European Investment Bank and can be used to support high risk research projects.	The European Commission will allocate up to EUR €1bn of funds available under FP7 to RSFF. In parallel, the EIB is contributing up to €1bn from its own resources. Together, these funds will be used to provide loans to corporations (or consortia) that seek financing to develop innovative products or to an ad hoc company created in order to develop a new risky concept. In either case, a project undergoes an assessment by the EIB to ensure that it is in line with EU policy objectives and that it is 'bankable', i.e. that assets and cash-flow considerations provide reasonable assurance that the loan can be reimbursed.	• Demand-driven instrument (no calls for proposals) • To expand the range of R&D activities promoted through FP7 • To increase private investment in RTD • To finance operations with a higher risk profile than the average EIB lending portfolio.	New funding instrument introduced for FP7. See: http://www.eib.org/rsff/ http://ec.europa.eu/invest-in-research/funding/funding02_en.htm

EU Mechanism	Funding Mechanism	Description	Objectives	Examples
Competitiveness and Innovation Framework Programme (CIP)	The CIP merges several already existing measures into one comprehensive programme to boost the competitiveness and productivity of European businesses (especially SMEs) while at the same time proposing support for eco-innovation and sustainable energy. The CIP adds a new risk capital instrument to foster SME start-ups. This non-grant-based instrument is aimed specifically at innovative and high-growth SMEs, which need capital during their growth phase.	The CIP consists of three sub-programmes: • The **Entrepreneurship and Innovation Programme**, which brings together activities in the areas of entrepreneurship, SMEs, industrial competitiveness and innovation; • The **ICT Policy Support Programme**, which promotes the speedy adoption of information and communication technologies (ICTs) and replaces the eTEN, eContent and Modinis programmes; • The **Intelligent Energy-Europe Programme**, brings together actions to accelerate the uptake and promotion of energy efficiency and to increase investments in and awareness-raising of renewable energy sources. This replaces the previous 'SAVE', 'ALTENER', or 'STEER' initiatives.	The objectives of the CIP are to stimulate the competitiveness of SMEs, fostering and promoting eco-innovation, energy efficiency and renewables, and accelerating the process leading towards a fully-fledged information society.	First call under the programme foreseen for mid-2007. See: http://cordis.europa.eu/fp7/cip_en.html

Table 4-3 EC Funding Instruments under FP7 and their use

4.3.2 Direct results and Spin-offs to other domains

In fairness to the efforts made during the last 10 years we summarize in the following table the main "spin-offs" which have resulted from the EC co-funded projects. The most important ones seem to be in security, military demining and environmental risk management. Schematically, they are:

R&D, support activity	Project (example)	Direct results	Spin-offs
Airborne surveys	DG DEV Airborne Minefield Detection Pilot Project ARC, SMART	Demonstrator systems, flight campaigns Demonstration of their cost/benefit potential	Environmental risk management applications (STREAM project). Enhanced Camcopter UAV (enhanced product). Coupling of airborne monitoring to GIS (border patrol applications).
Bulk explosive detection	MINESEYE		Explosive detection system (airport security, prototype).
Data fusion	GEODE, DREAM, LOTUS, DEMAND	Improved data fusion systems	Improved data fusion systems for other applications
Data taking	MINETEST, MINESIGN, MSMS	Signature DBs New test facilities Surrogate mines	Fundamental Research
GIS	DG DEV MINEDEMON, ISIS JRC activities	GIS for SE Europe	Environmental risk management applications
GPR	INFIELD, HOPE, DEMINE, DEMAND	Improved GPR (and GPR array) design	Enhanced understanding of multi-sensor probes. Enhanced understanding of GPR physics. Improved GPR (for civil engineering). Through-the-wall UWB radar.
Metal detection (EMI)	PICE, HOPE, MINESEYE	Improved MD (Schiebel ATMID, product)	Enhanced metal detectors in the field. Enhanced understanding of EMI physics (e.g. for NdT applications). Inversion models (for imaging applications).
MD array	LOTUS	Förster MD array (product)	Enhanced understanding of EMI physics (e.g. for NdT applications). Inversion models (for imaging applications).
MD+GPR	INFIELD, HOPE	Demonstrators	Handheld multi-sensor systems currently field tested (MINEHOUND)
Other ICT	TELEDIMOS		Environmental risk management applications
Trace explosive detection	BIOSENS	BIOSENS system Test campaigns	Environmental risk management applications. Explosive and drug detection system (BIOSENS, product). Counterterrorism. Enhanced understanding of explosive fate & transport.

Table 4-4 Spin-offs of EC co-funded RTD projects to other domains

4.3.3 Summary

A large concerted R&D effort, with focus on Humanitarian Demining, has been supported by the European Commission since 1994. There is no comparable purely civilian effort worldwide (the US Humanitarian Demining Technologies Program is supervised by the Army Night Vision Electronic Sensor Directorate (NVESD), and is quite different in scope).

Over the timeframe of this effort over €55 million were spent by the EC on Humanitarian Demining RTD [GAS2004]. Without going here into the detail of the individual projects, which are well covered in references such as [GAS2004, GAS2005], as well as on the DELVE website and in D4.1, it can be said that:

- Most of the funding was allocated either to the Framework Programmes for Research, in particular IST (administered by DG INFSO, and initially by other Directorates General, as well as by DG Research and DG Development on further aspects of Mine Action Research), or
- The EC Joint Research Centre at Ispra, Italy.
- The main focus of this R&D activity was on high-cost techniques, initially aimed at buried mine close-in detection, often using multi-sensor detectors with data fusion, then also at wide area survey as from FP5, and at some trace explosive detection activity (e.g. BIOSENS project) [EUDEM2_2003a].
- The timing of the individual calls is reported in the corresponding timelines (see D4.1), and in [EC2003].

At the *organizational level*, *R&D on Humanitarian Demining* in EC-FP6 was integrated into the wider "Improvement of Risk Management" strategic objective [COR2003], in order to generate important synergies with other types of risk and the humanitarian response to crises. This was in line with a paradigm shift in research, development and deployment and donor attitude from Humanitarian Demining towards restoring local communities and evidence based risk management [EUDEM2_2003b]. It also helped to move the focus of R&D into "areas where technology has already made a far more decisive impact on the overall mine clearance process (Area reduction and Information Management)" [GAS2005]. For details on the evolution of technology research priorities in HD (EC related) see also [EC2003].

A number of results where achieved, without enough recognition, amongst which [EUDEM2_2003a], [EC2003], [GAS2004]:

- At the sensor and system level: Radar on a chip, Test and Evaluation (Equipment Testing in "realistic" field conditions, with end user support, and creation of test facilities) and standardisation activities, improved Metal Detectors, Information services (advanced information management tools), Area Reduction techniques, alternative explosive detection techniques (APOPO giant rats).
- Support to demining operations (geographical information systems linked to the survey of mine affected countries, mapping).
- Advances in basic knowledge (which unfortunately have a low visibility).
- Much better understanding of environmental parameters and their influence.
- End user involvement (NGOs).
- Support measures to R&D (ARIS, EUDEM2 projects).
- A few systems were mature for more extensive testing.

It is however fair to say that the mine action community as a whole was not satisfied with the situation.

Indeed:

- One clear result has been missing, and
- "the delivery to deminers of new tools and equipment [...] has not met early expectations". Indeed, not enough research results have been turned into successful commercial products which have made Mine Action faster, more cost effective or safer.

General reasons for this have already been described in the previous sections, and include:

- Too high initial expectations[14] and problem "ignorance".
- Complexity of problem (e.g. advances in data fusion have been less than expected).
- Lack of long term commitment (financial, project's continuity) through all development phases.
- Lack of R&D coordination (but how much is practically achievable?).
- "Unfair competition" from tools established through practice, yet imperfectly assessed (MD, dogs).
- Cost of engineering and extensive Test and Evaluation are very high - €millions.
- The world-wide annual market for all Humanitarian Demining equipment is relatively small (20M€ - 30M€).
- Developments are not commercially viable without support or guarantees.

At EC level, although the EC Framework Programmes for Research are indeed aimed at successful commercial outcomes, as a matter of fact "the IST programme has proved to be largely unsuitable for the small-scale development needed in a field where there is only a very limited market" [GAS2005]. In fairness, however, other comparable R&D programmes did not do much better.

4.4 What could have been done at European level & Conclusions

Finally, we will now briefly analyse in a top-down approach what could have been done, going from the overall situation to the use of the available EC funding instruments, to terminate with a few considerations at the level of the single projects.

4.4.1 Overall considerations

At a general level, and with no surprise, we have to state again that the single most important bottleneck in Humanitarian Demining related R&D was probably the lack of an overall, coherent strategy (see also [COR2000] for a thorough discussion of end-to-end planning and a number of suggestions), integrating RTD actors, mine action donors and field practitioners (deminers) [GAS2004]. (This integration has been partly implemented in the case of already developed promising technologies, which still require extensive field testing, e.g. via ITEP.)

Industrial/End Users partnership in particular has often been acknowledged to be essential to speed-up the integration of new developments into demining operations ("risk management" on both sides) [EUDEM2_2003a].

[14] Although "...it is not clear whether the expectations of the EU programmes were realistic in view of the specific limitations of the EU R&D programmes, in particular with respect to their reliance on market forces to meet the needs of a limited demand, which in the final analysis is mostly government funded." [COR2003]

It would also have helped, in particular at European level, if new funding structures for Prototyping/T&E/ Production had been implemented. Such a process needs the key decision makers to be "on-board" and well informed, as well as the capability of convincing everybody that significant investments, a long term vision and the will to "carry through" are needed to get substantial rewards down the line.

4.4.2 EC Funding Instruments and their use

More could have been done at European level also in the following specific areas:

- Basic research (although this has been complemented by some national research initiatives).
- Infrastructures, in particular test and evaluation (perhaps also on the sensing side, e.g. pool of sensors to be used for T&E?).
- Conferences (a number of interesting events took place, such as Edinburgh'96 and '98, the Florence'99 Euroconference, EUDEM2-SCOT 2003, plus other events based on individual initiatives such as SusDem'97, however without a coherent European initiative comparable to the SPIE event series in the US).
- Networking (follow-up of ARIS NoE).
- New instruments to bridge the gap between R&D and field deployment, as discussed in detail elsewhere.

4.4.3 European R&D projects

A number of conclusions can also be drawn which are specific to the EC sponsored R&D projects (part of the following conclusions was reported in [GAS2003]):

Planning models, Test & Evaluation

Too many projects were still based on the "waterfall" model where one set of final tests determines the entire outcome of the project. For complex research activities, this method is generally considered as outdated and has several disadvantages. One recommendation issued in [GAS2003] was to encourage good management practices in projects and to review management more thoroughly during the regular review process. Also, data fusion should not be left "at the end", and intermediate system testing should be encouraged.

Partner competence and commitment

They appeared to vary widely, and sometimes this is discovered very late by the other members of the consortium. Improvements on project assessment methodology to highlight this area more would be welcome. Also, due to the 50% funding level for some partners not all of them had necessarily the same focus.

Correct effort assessment

The effort necessary to appropriately implement the data fusion and/or integration tasks has often been underestimated [COR2003].

Use of Road maps

It would seem beneficial to ask for a road map towards product development instead of the current requirement for exploitation and dissemination.

Pre-studies

In certain cases it might help to carry out pre-studies before launching a full-blown project (some projects were clearly partially unaware of the state-of-the-art).

Project follow-up

In practice it might be far from easy to assure that on the Commission Services side a project is closely followed and advised. This could however help to avoid that new projects repeat in part work carried out in older ones, or by others.

Industrial participation

Industry lost gradually interest in participating in EC sponsored multi-disciplinary development projects (sub-systems were insufficiently mature for the product development). This was also due to the fact that the EC is a funding body, not the end customer, and that the end requirements were not always well defined.

5 CONCLUSIONS

This report examined the major bottlenecks of the Humanitarian RTD activities over the past years and derived some lessons learned.

The study shows that the funding provided by the European Commission under the Framework Programme for Research and Development has led directly to the creation of an extensive portfolio of Humanitarian Demining R&D projects. The latter provided a range of research and supporting measures addressing the critical issues identified as a result of the regulatory policies developed in the field of Humanitarian Demining over the last ten years.

However, the range of *instruments* available to the EC to finance the necessary research and development were limited until the FP7 programme, which mainly led to projects under the umbrella of IST. As a first consequence, the IST programme unfortunately proved to be largely unsuitable for the small-scale development needed in a field where there is only a very limited market. From the review of the IST RTD projects it indeed appears that, at the current funding/project size, the typical timeframe of 2-3 years is very short for RTD projects, which include a fundamental research phase, a requirements phase, a specification phase, development and integration, demonstrator building, laboratory testing and initial field tests by end users, to be effective. As a second consequence, most of the research has been demonstrator-oriented and did lack (i) fundamental research under the EC Research Directorate, and (ii) the use of Co-operative research (formerly CRAFT[15]) supporting innovative SMEs, the main industrial organizations which have been involved in HD R&D. As a third consequence, appropriate funding structures to assure adequate prototyping/ T&E/production were badly lacking.

Moreover, compared to Environmental Risk Management, the timeframe for RTD in Humanitarian Demining has not been sufficiently synchronised with the timeframe of the EC regulations. The separation of the Mine Action and RTD funding streams did also negatively affect the take-up of new technologies. The last point has also been noted in [GAS2005]: “The current contracting process for mine clearance has a very significant negative impact on the take-up of new and existing technologies and should be changed as soon as possible in order to support technology take-up, instead of, as at present, effectively prohibiting it.”

As a conclusion, creating coherence between: (1) the EU policy based on political decisions, (2) R&D, testing and industrialization of equipment, and (3) timely deployment, requires a new way of coordinated thinking: “end-to-end planning” has to be supported by a well organized and coordinated organizational structure involving different DGs and even extending beyond the EU. This was not the case for Mine Action, but appears today to be the case for Environmental Risk Management.

Indeed, looking back on how Mine Action activities developed at the EC level following the Ottawa commitment taken since 1999, and the “the Anti-personnel Landmine Regulation” (EC No 1724/2001 and EC No 1725/2001[16]) to implement “The European Roadmap towards a Zero Victim Target”, it can be noted that the Mine Action subject became a key cross-cutting activity in the policies and activities of a number of Directorates General (EuropeAid, Environment, External Relations, Information Society and Media, Joint Research Centre, Research). As can be seen from the detailed presentation in D4.1 and the previous chapters of this document, funding has been made available by a number of these Directorates General to address the critical issue of achieving regulatory policy objectives in Mine Action. When the Inter-service consultation process between the various Directorates-General is also taken into consideration, it is evident that there has been and still is a considerable panoply of relevant actions being undertaken by the European Commission in order to meet the basic commitment of achieving the policy objectives.

However, it is as a direct result of the existence of this panoply of activity that the needs of the key stakeholders in the process have not been properly addressed at the level of clear messages and easy access to the outcomes of these activities. Establishing who is responsible in the EU Institutions and for which activities was, and partially still is, a nebulous and labour intensive process to unravel. Much could be

[15] http://sme.cordis.lu/craft/home.cfm

[16] Full background information about EC Mine Action is available in the documents “EC Mine Action 2002-2004” and “The European Roadmap towards a Zero Victim Target”, both of which can be downloaded from the EuropeAid website - http://europa.eu.int/comm/europeaid.

achieved by streamlining and integrating these activities under the umbrellas of – say – DG RELEX for policy related matters, the JRC for basic research activities, and DG Research and DG Information Society and Media for industrial and applied research undertaken through the R&D Framework Programme. This key objective could also be assisted through greater transparency in the Inter-service consultation process, which would benefit information flow and awareness of key decisions and developments affecting the delivery of systems in the field. In addition, we did miss funding and structural support to key dedicated Mine Action initiatives, contrary to what is the case for Environmental Risk Management under the GMES and INSPIRE initiatives.

The area of Mine Action is far from static, changing for example as threats to the civil population become more global and widespread (e.g. cluster ammunition). As a result, early accessibility to the outputs from RTD projects as well as their development are critical to the establishment of new standards and processes that can protect and benefit the affected countries. End users need to see real benefits before they are willing to adopt new technological solutions. It is therefore incumbent upon both the European Commission and the researchers to ensure that the added value from research outputs are made visible to the end user community (the marketplace) as quickly as possible to ensure significant and effective uptake.

The new FP7 Competitiveness and Innovation Programme (CIP), the Joint Technology Initiatives (JTIs) and Technology Platforms (ETPs), as well as the Risk Sharing Finance Facility (RSFF) will be a major asset in terms of consolidating research results efficiently and in a timely fashion. As a result of these new initiatives, the European research landscape is making significant moves towards the development of an integrated support structure which streamlines the needs of regulatory policy, the research community and the end user community.

It is therefore recommended that the European Commission addresses the issue of ***closely aligning*** project outputs from the RTD Framework Programme to the aims and objectives of the EC regulation as a matter of priority.

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6.3 Selected List of Links

In addition to the previous bibliography, we used the following selected list of links in the compilation of the Deliverables.

- European:
  - EuropeAid: Office de coopération EuropeAid
    http://ec.europa.eu/comm/dgs/europeaid/index_fr.htm
    EuropeAid - Anti Mines
    http://ec.europa.eu/europeaid/projects/mines/documentation_en.htm#pub_eur_comm
    EuropeAid - Who does What
    http://ec.europa.eu/europeaid/projects/mines/whodoeswhat_en.htm
  - Eur-Lex: Eurlex
    http://eur-lex.europa.eu/en/index.htm
    The Institutions' registers
    http://eur-lex.europa.eu/en/editorial/registre.htm
  - DG RELEX: The EU and anti-personnel landmines challenge - Overview
    http://ec.europa.eu/comm/external_relations/mine/intro/index.htm
    The EU and anti-personnel landmines challenge - Useful Links
    http://ec.europa.eu/comm/external_relations/mine/intro/links.htm

- European, FP Calls (historical):

  CORDIS IST Calls for Proposals IST 3rd Call launched on 10 February 2000

  http://cordis.europa.eu/ist/calls/200001.htm

  CORDIS IST Calls for Proposals

  http://cordis.europa.eu/ist/calls/calls.htm

  Welcome to the home page of the Esprit Programme

  http://cordis.europa.eu/esprit/

  CORDIS FP6

  http://cordis.europa.eu/fp6/dc/index.cfm?fuseaction=UserSite.FP6ActivityCallsPage&ID_ACTIVITY=124

- European, other:

  EUDEM2 project: http://www.eudem.info/

  JRC Projects: JRC Project Knowledge System - 2005

  http://projects.jrc.cec.eu.int/show.gx?Object.object_id=PROJECTS000000000001746A

- International:

  ITEP: http://www.itep.ws/itep1.html

  GICHD: http://www.gichd.ch/

- National, Germany:

  Federal Foreign Office Humanitarian mine action – aid projects promoted by the Federal Foreign Office

  http://www.auswaertiges-amt.de/diplo/en/Aussenpolitik/FriedenSicherheit/Abruestung/HumanitaeresMinenraeumen/Minen-AA-humHilfe.html

  BMBF Sicherheitsforschung - Forschung für die zivile Sicherheit

  http://www.bmbf.de/de/6293.php

- National, Japan:

  JST Home of Research and Development for Humanitarian Demining

  http://www.jst.go.jp/kisoken/jirai/EN/index-e.html

- National, Belgium:

  http://www.sic.rma.ac.be/Projects/

  http://www.etro.vub.ac.be

- National, The Netherlands:

  IRCTR: http://www.irctr.tudelft.nl/

- National, UK:

  ReliefWeb DFID Background Briefing Humanitarian mine action

  http://wwwnotes.reliefweb.int/w/rwb.nsf/d2fc8ae9db883867852567cb0083a028/88ef04722490e628c12569900057e497?OpenDocument

- National, US:

  The World's Landmine Problem and the U.S. Humanitarian Demining Program A Timeline

  http://www.state.gov/t/pm/rls/fs/22182.htm

  Milestones in Humanitarian Mine Action

  http://www.state.gov/t/pm/rls/fs/22948.htm

  Milestones in Humanitarian Mine Action Emergence of the Global Landmine Threat, Evolution of Landmine Policy and Development o

  http://www.state.gov/t/pm/rls/fs/58255.htm

- Other:

  SPIE: http://spie.org/x1636.xml?search_text=minelike&category=ProceedingsVolumes

7 ANNEX A - ENVIRONMENTAL RISK MANAGEMENT - EC REGULATION

In the following we summarize the main environmental risk management EC regulations since 1997 and the dates of their adoption. A graphical representation of the timetable is provided in Figure 7-1.

- **December 1997** - Council Decision 98/22/EC establishing a Community action programme in the field of civil protection. To help prevent natural and technological hazards and be prepared to handle the emergencies arising from them, the EU adopted a cooperation mechanism for relief activities. The Action Programme on Civil Protection was extended to 2006.
- **February 2000** - Commission adopts a White Paper on environmental liability with the objective of triggering a debate on how the principle could be applied to the EU environmental policy.
- **May 2001 -** Communication on the European strategy for sustainable development was approved, setting out the long-term objectives for sustainable development. It essentially concerns climate change, transport, health and natural resources (COM(2001) 264).
- **June 2001 -** Global Monitoring for Environment and Security (GMES) confirmed as the next flagship initiative for space, after Galileo, at the Gothenburg Summit of the EU. European Space Agency (ESA) is appointed main partner to the EU on GMES.
- **January 2002** - Commission issues a proposal for a directive on environmental liability, as a follow-up to the White Paper adopted in February 2000.
- **July 2002 –** Sixth Environment Action Programme (6th EAP) is adopted setting out the EU's ten year (2002-2012) policy programme for the environment. It identifies four key environmental priorities: climate change, nature and biodiversity, environment and health, and natural resources and waste (1600/2002/EC).
- **April 2004 -** Directive on environmental liability is finally approved by the Parliament and Council (2004/35/CE).
- **July 2004 –** Proposal for Infrastructure for Spatial Information in the European Community (INSPIRE) is adopted by the Commission.
- **April 2005 –** Commission adopts a proposal on the funding of civil protection measures from 2007-2013 (COM(2005) 113).
- **July 2005 –** Parliament adopts proposal text for INSPIRE.
- **November 2005 –** Commission Communication on "Global Monitoring for Environment and Security (GMES): from Concept to Reality" (COM(2005) 565).
- **October 2006 -** Commission starts mid-term review of the 6th EAP. It is due to report during 2007.
- **January 2007 –** The Conciliation Committee approves joint text of the INSPIRE directive (PE-CONS 3685/2006).

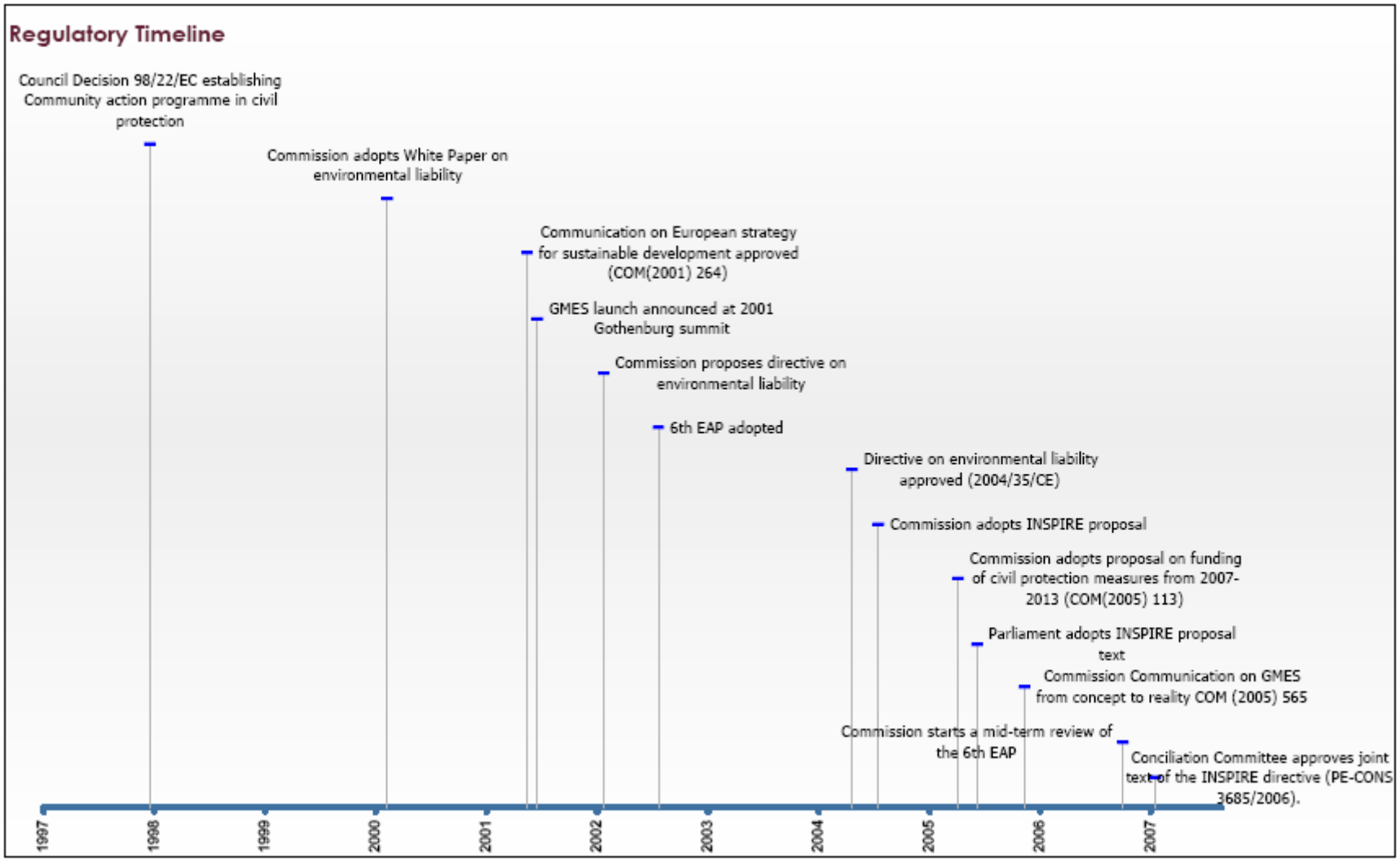

Figure 7-1 EC Environmental Risk Management Regulatory Timeline

8 ANNEX B - ENVIRONMENTAL RISK MANAGEMENT - EC SERVICES

The following tables outline the activities undertaken by those Commission services dealing with Environmental Risk Management aspects, as well as the main two regulations related to RTD in environmental risk management, namely INSPIRE and GMES.

RTD Services dealing with Environmental Risk Management	Unit	Name and description	Key contact	Contact details
DG Enterprise and Industry	H4	**Preparatory Action for Security Research (PASR)** - The Preparatory Action on 'Enhancement of the European industrial potential in the field of Security Research 2004-2006' focuses on the development of a European security research agenda to bridge the gap between civil research, as supported by EC Framework Programmes, and national and intergovernmental security research initiatives. Given the increasing importance of security concerns and, in light of the successful implementation of the PASR, Security Research is an integral part of FP7, with a total budget of about €1.35 billion.	Herbert Von Bose Head of Unit	herbert.von-bose@ec.europa.int See also: http://ec.europa.eu/enterprise/space/themes/spasec.html
DG Enterprise and Industry	H5	**Global Monitoring for Environment and Security (GMES) Bureau –** The GMES Bureau was established in June 2006 to coordinate GMES activity within the Commission and has the task of contributing to the long-term sustainability of GMES including presenting proposals for the GMES Management Structure. The Bureau gathers staff from Directorates General for Enterprise and Industry, Environment, Agriculture, Rural Development, Fisheries and Maritime Affairs, Information Society and Media, JRC and Research.	Valere Moutarlier Head of Unit	valere.moutarlier@ec.europa.int See also: http://ec.europa.eu/enterprise/space/gmes/index_en.htm
DG Environment	G3	**Research, Innovation and Sciences -** An important challenge for environmental policy is to make best use of research results and new scientific findings in policy development and implementation. The EU Research Framework Programme supports the 6th Environment Action Programme (6th EAP) and its policy priorities and thematic strategies through the transparent partnership of all the major stakeholders (DG Environment, DG Research, DG Information Society and Media).	Ian Clark Head of Unit	ian.clark@ec.europa.int See also: http://ec.europa.eu/environment/
DG Research	I2	**Sustainable Development -** Dedicated research funded under FP7 aims to define and estimate scientifically-based thresholds of sustainability and points of no-return, as a tool for the sustainable management and characterisation of the state of the environment. The research covers the estimation of cumulative, interactive effects over time caused by current and foreseeable actions, the coupling of data with policy judgements reflecting costs, the identification of the time and scale of potential damage.	Nicole Dewandre Head of Unit	nicole.dewandre@ec.europa.int See also: http://ec.europa.eu/research/environment/index_en.htm

RTD Services dealing with Environmental Risk Management	Unit	Name and description	Key contact	Contact details
DG Research	I5	**Climate Change and Environmental Risks (Global Change and Ecosystems) -** Systematic operational forecasting and modelling of climate change (atmospheric, terrestrial, marine-based) to improve understanding of extreme events, and to use data coming from the Global Monitoring for the Environment and Security (GMES) programme and other Global Observation Systems for the climate, oceans and terrestrial more effectively.	Elisabeth Lipiatou Head of Unit	elisabeth.lipiatou@ec.europa.int See also: http://ec.europa.eu/research/environment/index_en.htm
Joint Research Centre (JRC – Ispra)	G4	**Institute for the Protection and Security of the Citizen Hazard Assessment Unit (HAZAS) -** In order to help safeguard EU citizens against damage caused by natural disasters, human activities or criminal fraud, IPSC maintains and develops expertise in technologies relating to information and communication, space, and engineering. The Institute's scientific and technical services cover the full cycle from the conception of a new policy, through support in its development and implementation, to the monitoring and evaluation of eventual results.	Gerard Vollmer Head of Unit	gerard.vollmer@ec.europa.int See also: http://ipsc.jrc.cec.eu.int/
Joint Research Centre (JRC – Ispra)	G7	**Traceability and Vulnerability Assessment (TVAS) -** Action focuses on the review, comparison and development of methods for the security management of European Critical Infrastructures with respect, primarily, to the threat posed by terrorism, sabotage and other negative intentional acts. As well as terrorism, these methodological developments will also acknowledge the existence of traditional man-made and natural hazard, for which protection has also to be provided, resulting in the development of a comprehensive all-inclusive hazard protection strategy.	Andre Poucet Head of Unit	andre.poucet@ec.europa.int See also: http://ipsc.jrc.cec.eu.int/
Joint Research Centre (JRC – Ispra)	H3	**Institute for Environment and Sustainability, Global Environment Monitoring Unit –** Provides a long-term picture of the conditions in ecosystems identified according to the priorities of EU aid, development and international environmental policies. The action contributes to the GMES process by providing scientific support to partner institutions which have an operational mandate in Europe in the field of low resolution satellite observations for terrestrial environmental monitoring.	Alan Belward Head of Unit	alan.belward@ec.europa.int See also: http://ies.jrc.cec.eu.int/
DG Information Society and Media	F5	**Security -** the Security theme addresses technology building blocks for creating, monitoring and managing secure, resilient and always available transport and energy infrastructures that survive malicious attacks or accidental failures and guaranteeing continuous provision of services.	Jacques Bus Head of Unit	jacobus.bus@ec.europa.int See also: http://ec.europa.eu/information_society/index_en.htm

RTD Services dealing with Environmental Risk Management	Unit	Name and description	Key contact	Contact details
DG Information Society and Media	H4	**ICT for Sustainable Growth (ICT for Environmental Risk Management) -** EU-funded research helps pool Europe's scientific and industrial resources to create and demonstrate new ICTs which can reduce the environmental impact of everything from manufacturing and transport systems to our own homes. One of i2010's three pillars is to foster inclusion through ICTs. In addition, two EU Directives ensure Member State legislation on the collection, reuse, recycling and disposal of waste electrical and electronic equipment. The ICT for Sustainable Growth i2010 Flagship is currently under preparation.	Marta Nagy-Rothengass Head of Unit	marta.nagy-rothengass@ec.europa.int See also: http://ec.europa.eu/information_society/index_en.htm
DG Health and Consumer Protection	C7	**Risk Assessment –** A group of Scientific Committees provide the Commission with the sound scientific advice it needs when preparing policy and proposals relating to consumer safety, public health and the environment. The Committees also draw the Commission's attention to new or emerging problems which may pose an actual or potential threat.	Bernardo Delogu Head of Unit	bernardo.delogu@ec.europa.int See also: http://ec.europa.eu/dgs/health_consumer/index_en.htm
DG EuropeAid	E5	**Security and Migration –** The European Commission promotes conflict prevention, mediation, humanitarian intervention and demobilisation among the tools to underwrite the success of its development assistance programmes. In parallel with its peace-keeping and conflict-prevention efforts, the Commission is actively engaged in facilitating post-conflict rehabilitation, thereby ensuring a smooth transition between emergency aid and sustainable development assistance.	Helene Bourgade Head of Unit	helene.bourgade@ec.europa.int See also: http://ec.europa.eu/europeaid/general/index_en.htm

Table 8-1 EC services dealing with Environmental Risk Management (source: EC websites)

Special RTD Initiatives dealing with Environmental Risk Management	Description	Key Contact	Contact Details
Global Monitoring for Environment and Security (GMES) **www.gmes.info/**	The GMES concept was launched in 1998 and approved by the Gothenburg European Council and the European Space Agency in 2001. GMES was adopted by Commission Communication on "Global Monitoring for Environment and Security (GMES): from Concept to Reality" (COM(2005) 565) as an initiative aimed at streamlining European activities and funds in the field of Earth observation. GMES is the response to the need by Europe for geo-spatial information services. It provides autonomous and independent access to information for policy-makers, particularly in relation to environment and security.	Valere Moutarlier Head of Unit H5, Global Monitoring for Environment and Security (GMES) Bureau, DG Enterprise	valere.moutarlier@ec.europa.int See also: http://ec.europa.eu/enterprise/space/gmes/index_en.htm
Infrastructure for Spatial Information in Europe (INSPIRE) **www.ec-gis.org/inspire/**	INSPIRE is an initiative launched by the European Commission in 2002 under the auspices of the JRC and developed in collaboration with Member States and accession countries (adopted directive PE-CONS 3685/2006). It aims at making available relevant, harmonised and quality geographic information to support formulation, implementation, monitoring and evaluation of Community policies.	Alessandro Annoni, Eva Pauknerova European Commission INSPIRE Information Desk	alessandro.annoni@ec.europa.int eva.pauknerova@ec.europa.int

Table 8-2 Special RTD Initiatives dealing with Environmental Risk Management

9 ANNEX C - ENVIRONMENTAL RISK MANAGEMENT - FP6 CALLS

The following table summarizes the FP6 main calls with respect to environmental risk management.

Call Identifier	Call Area	Activities called	Publication Date	Closing Date
FP6-2002-Global-1 http://cordis.europa.eu/fp6/dc/index.cfm?fuseaction=UserSite.FP6DetailsCallPage&call_id=24	Thematic call in the area of Global Change and Ecosystems	Sustainable Development, Global Change and Ecosystems	17th December 2002	8th April 2003
FP6-2003-Global-2 http://cordis.europa.eu/fp6/dc/index.cfm?fuseaction=UserSite.FP6DetailsCallPage&call_id=78	Thematic call in the area of Global Change and Ecosystems	Sustainable Development, Global Change and Ecosystems	3rd July 2003	9th October 2003 (all instruments except SSA), 17th February 2004 (SSA)
FP6-2003-IST-2 http://cordis.europa.eu/fp6/dc/index.cfm?fuseaction=UserSite.FP6DetailsCallPage&call_id=74	Call 2 of the IST Priority	Applied IST Research addressing major societal and economic challenges	17th June 2003	15th October 2003
FP6-2004-Global-3 http://cordis.europa.eu/fp6/dc/index.cfm?fuseaction=UserSite.FP6DetailsCallPage&call_id=133	Call for proposals for indirect RTD actions under the specific programme for research, technological development and demonstration: 'Integrating and strengthening the European Research Area'	Sustainable Development, Global Change and Ecosystems	16th June 2004	26th October 2004, 8th March 2005
FP6-2005-IST-5 http://cordis.europa.eu/fp6/dc/index.cfm?fuseaction=UserSite.FP6DetailsCallPage&call_id=208	Call 5 of the IST Priority	Applied IST Research addressing major societal and economic challenges	18th May 2005	21st September 2005
FP6-2006-TTC-TU-Priority-6-3 http://cordis.europa.eu/fp6/dc/index.cfm?fuseaction=UserSite.FP6DetailsCallPage&call_id=280	Specific call to promote the participation of partners from Targeted Third Countries in projects for which contracts are already signed or under negotiation in priority thematic areas of research.	Sustainable Development, Global Change and Ecosystems	15th February 2006	16th May 2006

Table 9-1 Environmental Risk Management FP6 Calls

10 ANNEX D - ENVIRONMENTAL RISK MANAGEMENT - MAIN FUNDED PROJECTS

The following table lists the main funded European RTD project in the risk management domain.

Project Acronym, Number and web-site	Type of Action	Project Description	Partners	Budget	Duration
CHORIST – IST 033685 **www.chorist.eu**	Integrated Project Action Line: IST-2005-2.5.12 ICT for Environmental Risk Management	The main objective is to develop a system made of the following subsystems: 1. A fully integrated, reliable and performing alert chain delivering alerts to authorities with inputs from heterogeneous sensors, disparate agencies and citizens; 2. Heterogeneous communication means (radio, TV, sirens, GSM) to dispatch messages from authorities to as many citizens as possible within the crisis area and with limited delay; 3. Secured, rapidly deployable and interoperable voice and high data-rate telecommunication systems (incl. ad-hoc networks) for in the field risk response teams.	• EADS Defence and Security Systems, France • EADS Secure Networks, Finland • Teknillinen Koreakoulu, Finland • Joint Research Centre, Belgium • European Emergency Number Association, Belgium • Stichting Platform Mobile Messaging, Netherlands • Logica CMG Wireless Networks, Netherlands • Technische Universiteit Delft, Netherlands • Avanti Communications, UK • Bapco Limited, UK • Institute Eurocom, France • Thales Communications, France • Vodafone Espana, Spain • Tradia Telecom, Spain • Komcentra sro, Czech Republic • Datamat spa, Itlay	€12.89m (EC funding €7.09m)	1st June 2006 – 31st May 2009
DELVE – IST 2511779 **www.delve.vub.ac.be**	Specific Support Action Action Line: IST-2002-2.3.2.9 Improving Risk management	Given the take-up gap for European Humanitarian Demining technology it is of interest to produce Detailed summary of the ending of the R&D project funding in Europe and a thorough analysis of the reasons why this has happened. Analysis of the lessons learned which seeks to apply the results of the analysis prospectively to future R&D in the broad field of ICT for risk/crisis management, and provide useful support in defining the ToR for Risk and Crisis management for FP7. Seek for cooperation and develop synergy between RELEX, AIDCO, and INFSO in support of the previous objectives.	• Vrije Universiteit Brussel, Belgium • TNO Defence, Security and Safety, Netherlands	€220k	1st December 2005 – 31st March 2007
DEWS – IST 045453 **https://projectplace.com/pub/english.cgi/0/174344712**	Specific Targeted Research Project Action Line: IST-2005-2.6.5.1.e Tsunami	DEWS addresses the major shortcomings and societal problems related to early warning systems for tsunamis and other coastal hazards by developing an innovative platform and services for the disaster management cycle between GITEWS hazard detection and warning/alarm.	• Saab Aktiebolag, Sweden • Statens Raeddningsverk, Sweden • Citizen Alert Services bv, Netherlands • National Research Institute for Earth Science and Disaster Prevention • Università di Bologna, Italy • Datamat spa, Italy	€6.5m (EC funding €4.02m)	1st February 2007 – 31st January 2010

Project Acronym, Number and web-site	Type of Action	Project Description	Partners	Budget	Duration
			• Ingegneria Informatica spa, Italy • Teknillinen Korkeakoulu, Finland • Institute of Geological and Nuclear Sciences, New Zealand • Atos Origin, Spain • Geoforschungszentrum Potsdam, Germany		
DYVINE – IST 034307 **www.dyvine.eu**	Specific Targeted Research Project IST-2005-2.5.12 ICT for Environmental Risk Management	The objective of DYVINE is to design, develop and test a representative version of a surveillance network based on visual sensors (images and video, in situ or airborne), which can be configured as a function of the requirements and events. This network can be used to monitor any kind of area or infrastructure, which can be threatened by natural of industrial disasters.	• EADS Defence and Security Systems, France • Commissariat à l'energie atomique, France • Martec, France • Realvez sa, France • EADS Deutschland GmBH, Germany • White Balance Projects Pool Agency GmBH, Germany • University of Surrey, UK • Municipalidad de Miraflores, Peru • Katholieke Universiteit Leuven, Belgium • Universidad Politecnica de Valencia, Spain • Ecole Polytechnique de Lausanne, Switzerland	€2.93m (EC funding €1.81m)	1st September 2006 – 31st August 2008
ERMA – IST 034889 **www.erma-project.org**	Specific Targeted Research Project IST-2005-2.5.12 ICT for Environmental Risk Management	ERMA aims to build a reference platform for risk management (natural/man-made disasters) with a specific focus on needs of small and medium-sized communities. These may be public bodies as well as private sector organisations with shared obligations and duties for risk prevention and response. Hence, specific attention will be devoted to a customisable platform, tailored to the need for the individual risk at hand.	• Unified Messaging Systems as, Norway • Yellowmap ag, Germany • CAS Software ag, Germany • Fraunhofer Gesellschaft, Germany • Universidad Politecnica de Catalunya, Spain • Comunidad Portuaria de Santander, Spain • Institut National de L'Environnement Industriel et des risques, France • Consiliul Local Targu Lapus, Rumania	€2.93m (EU funding €1.49m)	1st September 2006 – 31st August 2008
EU-FIRE – IST 035299 **www.eufire.org**	Specific Targeted Research Project IST-2005-2.5.12 ICT for Environmental Risk Management	EU-FIRE deals with fire detection through the exploitation of new technologies, and will provide the following breakthrough advancements: (1) A completely new design of acoustic systems for volumetric scanning, (2) A completely new design of fibre optic sensors networks and optoelectronic piloting units for the detection of changes in fire associated parameters, such as temperature and gaseous emission, (3) A new acquisition unit for data collection from innovative units as well as from traditional sensors, such as cameras, anemometer, hygrometer, and manometer.	• D'Appolonia sa, Italy • Centro Italiano Ricerche Aerospaziali, Italy • University of Cyprus • Associacao para o Desenvolvimento da Aerodinamica Industrial, Portugal	€2.49m (EU funding €1.43m)	Ist September 2006 – 31st August 2009
EURITRACK – IST 511471 **www.euritrack.org**	Specific Targeted Research Project	EURITRACK aims at increasing the security of the seaports by developing a European Illicit Trafficking Countermeasures Kit to non-intrusively detect	• Commissariat à l'Energie Atomique, France • Saphymo, France • Direction Générale des Douanes et des Droits	€4.2m (EU funding	1st September 2004 – 31st

Project Acronym, Number and web-site	Type of Action	Project Description	Partners	Budget	Duration
	Action Line: IST-2002-2.3.2.9 Improving Risk management	explosives or other threat materials concealed in shipping containers. The system will consist of an innovative Tagged Neutron Inspection System (TNIS) that will non-intrusively permit an assay of the chemical composition of suspect contents located by X-Ray radiography.	Indirects, France • Société Anonyme des études et Réalisations Nucléaires, France • Ruder Boskovic Institute, Croatia • Joint Research Centre, Belgium • Andrsjez Soltan Institute for Nuclear Studies, Poland • Kungliga Tekniska Hoegskolan, Sweden • Istituto Nazionale di Fisica Nucleare, Italy • Costruzione Apparecchiature Elettroniche Nucleari, Italy	€2.45)	August 2007
EUROPCOM – IST 004514 **www.ist-europcom.org**	Specific Targeted Research Project Action Line: IST-2002-2.3.2.9 Improving Risk management	The project will investigate and demonstrate the use of UltraWideBand (UWB) radio, to allow the precise location of personnel to be displayed in a control centre and simultaneously improve communications reliability. The feasibility of using UWB to search for survivors buried beneath rubble and to generate simple maps will also be investigated.	• Thales Research and Technology, UK • Thales Security Systems Ltd, UK • IMST GmBH, Germany • Technische Universitaet Graz, Austria • Technische Universiteit Delft, Netherlands	€4.2m (€2.5m EU funding)	1st September 2004 – 31st December 2007
European Shared Environmental System in support of Environmental Policies (SEIS) – DG Environment Project		SEIS is a collaborative initiative serving two main purposes: Improve the quality, accessibility and sharing of environmental data and information within Europe and provision of services to public policy makers and citizens; Offer to MS and EU institutions an efficient reporting system to fulfil obligations related to Community environmental policies and legislation. A Commission Communication is due in 2007 which will set out: • the political framework for SEIS, • an integrated and common implementation strategy and its links with INSPIRE, GMES, GEOSS.	• DG Environment, Belgium • JRC, Italy • European Environment Agency • ESTAT	Unknown	Unknown
HALO – Aerospace 502869	Specific Support Action Action Line: FP6 Aerospace	• Harmonised Coordination of the Atmosphere, Land and Ocean Integrated Projects of the GMES Backbone. • Development of the FP7 work programme for the build-up of the GMES pre-operational capabilities.	• European Centre for Medium Range Weather Forecasts, UK • Alcatel Space, France • Institut Français de Recherche pour L'Exploitation de la Mer, France • EADS Astrium SAS, France • Infoterra GmBH, Germany	€900k	1st December 2004 – 31st January 2007
INTAMAP – IST 033811 **www.intamap.org**	Specific Targeted Research Project	The main objective of this project is to develop an interoperable framework for real time automatic mapping of critical environmental variables by	• Universiteit Utrecht, Netherlands • Universiteit Waginingen, Netherlends • Universitaet Klagenfurt, Austria	€2.15m (€1.86m EU	1st September 2006 – 31st

Project Acronym, Number and web-site	Type of Action	Project Description	Partners	Budget	Duration
	Action Line: IST-2005-2.5.12 ICT for Environmental Risk Management	extending spatial statistical methods and employing open, web-based, data exchange and visualisation tools.	• Keynetix Ltd, UK • University of Aston, UK • Joint Research Centre, Belgium • Technical University of Crete, Greece • Bundesamt fuer Strahlenschutz	funding)	August 2009
InterRISK – IST 035253 **www.interrisk.nersc.no**	Specific Targeted Research Project Action Line: IST-2005-2.5.12 ICT for Environmental Risk Management	The overall objective is to develop a pilot system for interoperable GMES monitoring and forecasting services for environmental risk and crisis management in European marine and coastal areas. This pilot will consist of a web portal offering access to all services, a suite of components for registration, maintenance and discovery of services, and a network of services in Norwegian, UK/Irish, French, German, Polish and Italian coastal waters.	• Stiftelsten Nansen Centre, Norway • Norsk Institutt For Vanforskning, Norway • Meteorologisk Institutt, Norway • Marine Institute, Ireland • University College Cork, Ireland • Plymouth Marine Laboratory, UK • Spacebel, Belgium • Optimare Sensorsysteme ag, Germany • Ruhr Universitaet Bochum, Germany • GKSS GmBH, Germany • Instytut Oceanologii Polskiej Akademii Nauk, Poland • Innova, Italy • Università degli studi del Piemonte Orientale, Italy •	€4.26m (€2.46m EU funding)	1st September 2006 – 31st August 2009
MEDIGRID – Sustainable Development 4044 **www.eu-medigrid.org**	Specific Targeted Research Project Action Line: SUSTDEV-2004-3.IV.2.c Natural disasters	MEDIGRID created a distributed framework of multi-risk assessment for post-fire natural disasters. The project integrated models of forest fire behaviour, soil erosion, vegetation regeneration, flash floods and landslides, developed or elaborated in frame of previous EC projects. These models were upgraded to web applications in order to run remotely as web services over the internet. The data structure and organization was designed to comply with the concept of respective EC initiatives (INSPIRE, EU-MEDIN, ESPON) for data standardisation.	• Algosystems, Greece • Entente Interdépartementale en vue de la Protection de la Foret et de L'Environnement contre L'Incendie France • Associacao para o Desenvolvimento da Aerodinamica Industrial, Portugal • Slovakian Academy of Sciences • Tecnoma sa, Spain • University of Newcastle-upon-Tyne, UK	€1.36m (€900k EU funding)	1st November 2004 – 31st October 2006
MITRA – IST 511361 **http://www.mitraproject.info/html/overview.html**	Specific Targeted Research Project Action Line: IST-2002-2.3.2.9 Improving Risk management	The objective of MITRA is to prototype a new operational system based on regional responsibilities for the monitoring of dangerous goods transportation in Europe. This concept, derived from the Air Traffic Control domain, aims at providing the Civil Security centres with a real-time knowledge of the position and contents of dangerous vehicles circulating in their responsibility area, warning and alert displays in case of dangerous situations, and crisis management information, allowing intervention teams to react immediately in case of an accident, with a maximum of safety.	• M3 Systems sàrl, France • Institut National de L'Environnement Industriel et des risques, France • Association pour la Recherche et le Développement des méthodes et Processus Industriels, France • CGX Systèmes, France • Institut National D'Etudes de la Sécurité Civile, France • Universitat Politecnica de Catalunya, Spain • Igegneria des systemas para la defensa des Espana, Spain • Centro de Observacion y Teledeteccion Espacial,	€2.82m (€1.45m EU funding)	26th July 2004 - ???

Project Acronym, Number and web-site	Type of Action	Project Description	Partners	Budget	Duration
			Spain • Deimos Space, Spain • Movingworld kg, Germany • Kayser-Threde GmbH, Germany • Telematica, Germany • Deutsches Zentrum fuer Luft und Raumfahrt, Germany		
NARTUS – IST 034895 **www.publicsafetycommunication.eu**	Specific Support Action Action Line: IST-2005-2.5.12 ICT for Environmental Risk Management	NARTUS is focused on creating a European Public Safety Communication Forum which will establish a European platform and roadmap for future public safety communication and will help to facilitate European integration in the area of Public Safety with particular focus on public safety communications and information systems. Once established, it is anticipated that the Forum will endure after the conclusion of the Project and will continue to build on the work completed during the Project lifetime.	• Teknillinen Koreakoulu, Finland • Universidad Politecnica de Madrid • The International Emergency Management Society, Switzerland • Martel GmBH, Switzerland • National Technical University of Athens, Greece • Squaris, Belgium • EADS Secure Networks, France • Thales Communications, France • Bapco Ltd, UK	€760k	1st June 2006 – 31st May 2009
OASIS – IST 004677 **www.oasis-fp6.org**	Integrated Project Action Line: IST-2002-2.3.2.9 Improving Risk management	OASIS aims to define a generic crisis management system to support the response and rescue operations in case of large scale disasters. The project: 1) analyses user requirements to extract European generic system requirements, 2) specifies and designs a true generic, interoperable and open system architecture which will allow easy deployment at every level of the action chain (local, regional, national and European).	• EADS Defence and Security Systems, France • EADS Astrium, France • BAe Systems, UK • Cranfield University, UK • Thales Communications, Norway • SINTEF, Norway • EDISOFT, Portugal • Russian Academy of Sciences • Datamat spa, Italy • Fraunhofer Gesellschaft, Germany • Dornier Gesellschaft, Germany • Ericsson Microwave, Sweden • Medium Soft as, Czech Republic	€19.55m (€10.5m EU funding)	1st September 2004 – 31st August 2008
ORCHESTRA – IST 511378 **www.eu-orchestra.org**	Integrated Project Action Line: IST-2002-2.3.2.9 Improving Risk management	The objectives of ORCHESTRA are: - To design an open service-oriented architecture for risk management - To develop the software infrastructure for enabling risk management services - To deliver an infrastructure integrating spatial and non-spatial services for risk management - To validate results in a multi-risk scenario - To provide software standards for risk management applications	• Atos Origin, Spain • Typas Tecnicas y Proyectos, Spain • Datamat spa, Italy • Intecs spa, Italy • Joint Research Centre, Belgium • The Alliance of Maritime Regional Interests in Europe, Belgium • Ordnance Survey, UK • Open GIS Consortium (Europe) Ltd, UK • BMT Corda Ltd, UK • Eidgenoessische Technische Hochschule Zurich, Switzerland • Arc Siebersdorff Research, Austria	€13.75 (€8.2 EU funding)	1st September 2004 – 31st August 2007

Project Acronym, Number and web-site	Type of Action	Project Description	Partners	Budget	Duration
			• Hochschule fuer Technik und Wirtschaft des Saarlandes, Germany • Fraunhofer Gesellschaft, Germany • Bureau de Recherches Géologiques et Minières, France		
OSIRIS – IST 033475 **www.osiris-project.eu**	Integrated Project Action Line: IST-2005-2.5.12 ICT for Environmental Risk Management	The main objective of OSIRIS is to enhance the overall efficiency of the in-situ data processing chain by connecting in-situ sensors via an intelligent and versatile network infrastructure that will enable the end-users to access to multi-domain sensors information. In-situ observations are observations captured locally, i.e. within a few kilometres of the object or phenomenon being observed, thus including measurements taken at ground station or by aircraft. Space-based and in-situ observations are complementary, as both have limitations.	• Thales Communications, France • Réseau Euro-Mediterranean d'information et de Formation à la gestion des Risques, France • Stadt Aachen, Germany • APS Gesellschaft, Germany • Westfaelische Wilhelms – Universitaet Muenster, Germany • Regione Toscana, Italy • Fondazione per il Clima e per la Sostenibilità, Italy • ESYS plc, UK • Thales Research and Technology, UK • Hydrogeotechnika, Poland • GMV, Spain • Vlaamse Instelling voor Technologische Onderzoek, Belgium	€10.98m (€6.46 EU funding)	1st September 2006 – 28th February 2009
REACT – IST 33607 **www.react-project.org**	Specific Targeted Research Project Action Line: IST-2005-2.5.12 ICT for Environmental Risk Management	REACT aims at reducing risks to citizens and the environment by enhancing the interactivity of citizens with Emergency Services and by providing added value to integrated information coming from disparate sources. REACT supports existing emergency systems by providing an interoperable multimedia Enhanced Emergency Call Service.	• Intelligence for Environment and Security, Italy • Ministero dell'Interno, Italy • Sineura, Italy • Stadt Aachen, Germany • Vereinigung High Tech Marketing, Austria • Voice Insight, Belgium • Reform ec Druzba za Mednarovno Trgovino, Slovenia • Northgate Information Solutions, UK • Sussex Police Authority, UK • Oxford Computer Consultants, UK	€3.92m (€1.98m EU funding)	1st September 2006 – 28th February 2009
RESCUER – IST 511492 **www.rescuer-ist.net**	Specific Targeted Research Project Action Line: IST-2002-2.3.2.9 Improving Risk management	RESCUER focuses on the development of an intelligent Information and Communication Technology and a mechatronic Emergency Risk Management tool and on testing it in five Improvised Explosive Device Disposal, and Civil Protection Rescue Mission scenarios.	• Budapesti Muszaki Es Gazdasagtudomanyi Egyetem, Hungary • Council of Ministers, Bulgaria • University of Rousse, Bulgaria • University of Wales, UK • Democritus University of Thrace, Greece • Duvideo, Portugal • Tardito Costruzioni Impianti, Italy • Università degli studi di Genova, Italy • Robotnik Automation, Spain	€2.46m (€2m EU funding)	1st December 2004 – 30th November 2006
RISE – Aerospace 12141	Specific Support Action	The project aims at defining geospatial data implementation specifications with the following main	• Eurogeographics, France • Bundesamt fuer Kartographie und Geodäsie,	€1.13m	1st September

Project Acronym, Number and web-site	Type of Action	Project Description	Partners	Budget	Duration
	Action Line: FP6 Aerospace	objectives. To: - Be user driven and meet the requirements of GMES, INSPIRE, other EC policies and EU strategic objectives - Develop and test a subset of the implementation specifications - Define a repeatable capability for further development, adoption and implementation of the specifications	Germany • Lantmateriet, Sweden • Open Geospatial Consortium (Europe) Ltd, UK • QinetiQ, Ltd, UK		2005 – 31st August 2007
S@NY SENSORS ANYWHERE – IST 033564 **www.sany-ip.eu**	Integrated Project Action Line: IST-2005-2.5.12 ICT for Environmental Risk Management	The SANY objectives are to: 1) Specify a standard open architecture for fixed and moving sensors and sensor networks capable of seamless "plug and measure" and sharing (virtual networks) 2) Develop and validate re-usable data fusion and decision support service building blocks.	• BMT Cordah Ltd, UK • University of Southampton, UK • Fraunhofer Gesellschaft, Germany • Institut Géographique National, France • Umweltbundesamt GmBH, Austria • Eidgenoessische Technische Hochschule Zurich, Switzerland	€11.24m (€7m EU funding)	1st September 2006 – 31st August 2009
SCIER – IST 035164 **www.scier.eu**	Specific Targeted Research Project Action Line: IST-2005-2.5.12 ICT for Environmental Risk Management	SCIER will design, develop, and demonstrate an integrated system of sensors, networking and computing infrastructure for detecting, monitoring, predicting and assisting in the crisis management of natural hazards or accidents at the "urban-rural-interface" (URI), i.e., in areas where forests and rural lands interface with homes, other buildings and infrastructures. The overall goal of the SCIER system is to make the much-neglected URI zone safer for the European citizens against any type of natural hazards or accidents.	• Epsilon International, Greece • Greek Research and Technology Network • Ethniko Idryma Agrotikis Ereunas, Greece • National and Kapodistrian University of Athens, Greece • DHI Hydroinform, Czech Republic • Tecnoma, Spain • G4S Security Services, UK • Entente Interdépartementale en vue de la Protection de la Foret et de l'environnement, contre l'incendie, France • Centre Suisse de l'Electronique et de Microtechnique, Switzerland • Associacao para o Desenvolvimento da Aerodinamica Industrial, Portugal	€3.27m (€2.09m EU funding)	1st July 2006 – 31st December 2008
SIMDAT – IST 511438 http://www.scai.fraunhofer.de/710.0.html	Integrated Project IST-2002-2.3.2.8 Grid based systems for complex problem solving	The objectives of SimDat are to accelerate the uptake of existing Grid techniques and architectures in a variety of industries and services, provide standardised solutions for some of the missing capability, and to validate the effectiveness of Grid in simplifying processes used for the solution of complex, data-centric problems.	• Fraunhofer Gesellschaft, Germany • Audi ag • Deutscher Wetterdienst, Germany • Eumetstat, Germany • Intel GmBH, Germany • MSC Software GmBH • Oracle Deutschland GmBH • Ontoprise GmBH, Germany • Universitaet Karlsruhe, Germany • LMS International nv, Belgium • Université Libre de Bruxelles, Belgium • EADS CCR, France • ESI Software, France	€18.43m (€11m EU Funding)	30th July 2004 - ???

Project Acronym, Number and web-site	Type of Action	Project Description	Partners	Budget	Duration
			• Idestyle Technologies, France • Météo-France, France • Regienov-Renault Recherche Innovation, France • Bae Systems (Operations) Ltd, UK • European Centre for Medium Range Weather Forecasts, UK • GlaxoSmithKline Research and Development, UK • IBM UK Ltd • Inforsense Ltd, UK • Lion Bioscience Ltd, UK • Met Office, UK • NEC Europe Ltd, UK • University of Southampton, UK		
STARRS – IST 033742 **http://uranium.stu-dif.com/sensorsprocessing**	Specific Targeted Research Project Action Line: IST-2005-2.5.12 ICT for Environmental Risk Management	STARRS focuses on the design and development of technology in search and rescue operations (to detect and locate victims' position with a good accuracy as well as to allow alert broadcasting to people in emergency situations.) People in danger will be detected, located and rescued through their basic cellular radio handsets (GSM and UMTS mobile phones). Additionally, headquarters of rescue teams will be able to know the location of rescuers within the intervention area through their professional handsets (TETRA and TETRAPOL mobile handsets).	• Thales Communications, France • Ecole National Supérieure des Officiers de Sapeurs.Pompiers, France • Société Française du Radiotéléphone, France • Catholic University of Leuven, Belgium • Oulon Iliopisto, Finland • Joanneum Research Forschungsgesellschaft mbh, Austria • Vodafone, Greece • Teletel Telecommunications and Information Technology sa, Greece • Cyprus Fire Service • University of Cyprus	€3.91m (€2.43m EU funding)	1st October 2006 – 30th September 2008
STREAM – IST 51171 **www.stream.vub.ac.be**	Specific Targeted Research Project Action Line: IST-2002-2.3.2.9 Improving Risk management	The STREAM goals are the development of products and procedures to support in humanitarian crisis management. Products for survey and decision support include: - Mission planning and management, for space-/air-borne and field survey - Mobile Computing Infrastructure for field survey including ground truth acquisition and verification tools - Remote sensing data analysis and interpretation - Information Management and Decision Support Information Communication and Broadcasting	• Vrije Universiteit Brussel, Belgium • Polytechnic University of Bucharest, Rumania • Bactec International Ltd, UK • Foersvarsmakten, Sweden • Stiftung Menschen gegen Minen, Germany • GTD Sistemas de Informacion, Spain	€3.97m (€2.5 EU funding)	1st December 2004 – 31st May 2008
WARMER – IST 034472 **http://www.zetaced.com/projectwarmer/**	Specific Targeted Research Project Action Line: IST-2005-2.5.12 ICT for Environmental Risk Management	WARMER aims at creating an extended system for on-line water monitoring with main purpose of risk management, integrating mixed technology in the areas of semiconductors, analytical chemistry, micro-mechanical fluidic systems, ICT, remote sensing and extensive networking of environmental water monitoring data.	• Systems Technology Advance, Italy • St Petersburg State University, Russian Federation • YSI Hydrodata, UK • University of Aberdeen, UK • Warsaw Polytechnic, Poland • Institute of Electronic Technology, Poland • Stiftelsen Nansen Senter for Fjernmaalen, Norway	€2.45m (€1.83m EU funding)	1st September 2006 – 31st August 2009

Project Acronym, Number and web-site	Type of Action	Project Description	Partners	Budget	Duration
			• Universidad Autonoma de Barcelone, Spain • Universitaet fuer Bodenkultur Wien, Austria		
WIN – IST 511481 **http://www.win-eu.org**	Integrated Project Action Line: IST-2002-2.3.2.9 Improving Risk management	The Wide Information Network (WIN) Integrated Project has the objective of integrating all existing reference results or initiatives to contribute to the design, the development, and the validation of what could be referred to as a "European Risk Management information infrastructure". This information infrastructure will be a major element of the future overall European Spatial Data Infrastructure (ESDI).	• Alcatel Space, France • Centre National d'Etudes Spatiales, France • Globalware International, France • Collecte Localisation Satellite, France • Générale D'Infographie, France • Université Marc Bloch, France • Cronos nv, Belgium • Join Research Centre, Belgium • Starlab Barcelona, Spain • GMV, Spain • GTD Sistemas de Informacion, Spain • Kell sra, Italy • Telespazio, Italy • Nansen Senter for Miljoe og Fjernmaeling, Norway • ESYS plc, UK	€8.27m (€4.4m EU funding)	1st September 2004 – 31st August 2007
WINSOC – IST 033914 **http://www.winsoc.org/**	Specific Targeted Research Project Action Line: IST-2005-2.5.12 ICT for Environmental Risk Management	WINSOC addresses the development of a totally innovative design methodology, where the high accuracy and reliability of the whole network is achieved by introducing a suitable coupling among adjacent, low cost sensors, that gives rise to distributed decisions, much more accurate than that of each single sensor, without the need for sending all data to a fusion centre.	• Selex Communications, Italy • Dune srl, Italy • Università degli Studi La Sapienza Roma, Italy • Intracom Telecoms Solutions, Greece • Ecole Polytechnique Fédérale de Lausanne, Switzerland • Sapienza, Spain • Universitat Politecnica de Catalunya, Spain • Ceske Centrum pro vedu a Polecnost, Czech Republic • Commissariat à l'Energie Atomique, France • Antrix Corporation Ltd, India • Amrita Vishwa Vidyapeetham, India	€3.86m (€2.44m EU funding)	1st September 2006 – 28th February 2009
WISECOM – IST 34673 **http://www.wisecom-fp6.eu**	Specific Targeted Research Project Action Line: IST-2005-2.5.12 ICT for Environmental Risk Management	WISECOM studies, develops, and validates candidate rapidly deployable lightweight communication infrastructures for emergency conditions. The system will integrate several terrestrial mobile radio networks - comprising GSM, UMTS, WiFi, WIMAX and TETRA - over satellite systems (Inmarsat BGAN and DVB-RCS), using lightweight and rapidly deployable technologies, and including location-based services.	• German Aerospace Centre • TriaGnoSys, Germany • Steinbeis Foundation, Germany • Reach-U, Estonia • Alcatel Alenia Space, France • EADS Astrium, France • AnsuR Technologies, Norway	€2.53m (1.77m EU Funding)	1st September 2006 – 29th February 2008

Table 10-1 Environmental Risk Management – Main funded European projects

11 ANNEX E - TECHNOLOGY READINESS LEVELS OVERVIEW

The following table summarizes the technology readiness levels used in this document. For their use within the framework of Humanitarian Demining RTD see also [BRU2006].

Technology Readiness Level	Description
1. Basic principles observed and reported.	Lowest level of technology readiness. Scientific research begins to be evaluated for applications. Examples might include paper studies of a technology's basic properties.
2. Technology concept and/or application formulated.	Invention begins. Once basic principles are observed, practical applications can be postulated. The application is speculative and there is no proof or detailed analysis to support the assumptions. Examples are still limited to paper studies.
3. Analytical and experimental critical function and/or characteristic proof of concept.	Analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology are undertaken. Examples include components that are not yet integrated or representative.
4. Technology component and/or basic technology sub-system validation in laboratory environment.	Basic technology components are integrated. This is relatively "low fidelity" compared to the eventual system. Examples include integration of "ad hoc" hardware in a laboratory.
5. Technology component and/or basic sub-system validation in relevant environment.	Fidelity of sub-system representation increases significantly. The basic technological components are integrated with realistic supporting elements so that the technology can be tested in a simulated environment. Examples include "high fidelity" laboratory integration of components.
6. Technology system/subsystem model or prototype demonstration in a relevant environment.	Representative model or prototype system, which is well beyond the representation tested for TRL 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high fidelity laboratory environment or in simulated operational environment.
7. Technology system prototype demonstration in an operational environment.	Prototype near or at planned operational system. Represents a major step up from TRL 6, requiring the demonstration of an actual system prototype in an operational environment, such as in an aircraft or vehicle. Information to allow supportability assessments is obtained. Examples include testing the prototype in a test bed vehicle.
8. Actual technology system completed and qualified through test and demonstration.	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of Demonstration. Examples include test and evaluation of the system in its intended detection system to determine if it meets design specifications, including those relating to supportability.
9. Technology System "accredited" through successful mission operations.	Application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation and reliability trials. Examples include using the system under operational mission conditions.

Table 11-1 Technology Readiness Levels Table (source [MAN1995])